Heating Piping & Air Conditioning

SEPTEMBER 1958

Single copy price 75c

Contents ..... page 5

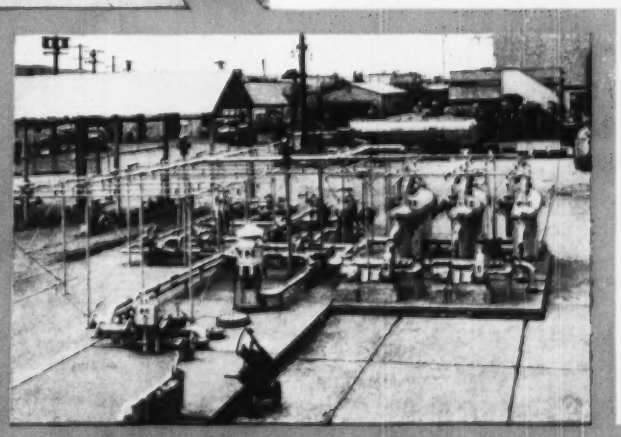
. . . for Consulting Engineers • Mechanical (Heating, Piping, and Air Conditioning) Contractors • Engineers with Plants and Big Buildings

Scheduled Maintenance Keeps Hospital Cooling in Top Shape

. . . . page 117

ASHAE Journal Section

. . . . page 153

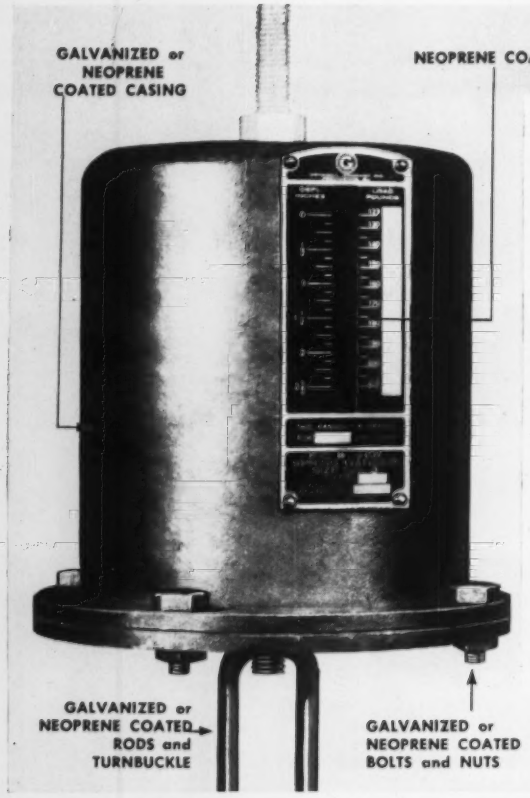


Jet Fuel Piping System Delivers 1200 Gpm to "Stratofort"

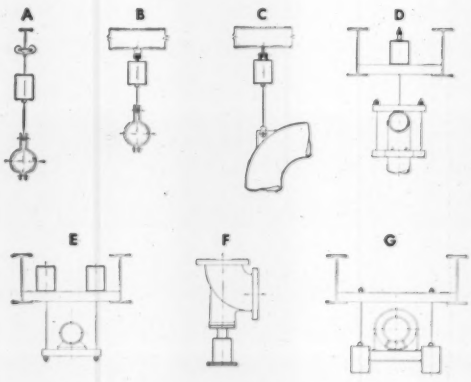
. . . page 113

corrosion-resistant, weather-resistant

GRINNELL VARIABLE SPRING HANGERS


GALVANIZED or NEOPRENE COATED CASING
NEOPRENE COATED SPRING
GALVANIZED or NEOPRENE COATED RODS and TURNBUCKLE
GALVANIZED or NEOPRENE COATED BOLTS and NUTS

AVAILABLE IN 7 TYPES FOR THESE TYPICAL APPLICATIONS



(A) Rod threaded to top cap (B) Furnished with single lug (C) Two lug style (D) Top adjusting (E) Adjustable top and bottom (F) For floor support (G) Trapeze assembly.

In addition to their proven corrosion and weather resistance, these spring hangers offer other features.

- Maximum variation in supporting force for standard spring models per ½" of deflection is 10½% of rated capacity — in all sizes.
- Precompression (a patented feature) assures operation of spring within its proper working range, as well as saving valuable erection time. Reduced over-all height saves space.
- 21 sizes available from stock for load ranges from 50 lbs. to 28,200 lbs.
- Available in 3 spring lengths for maximum travel of 1¼, 2½, and 5 inches.
- Installation simplified by integral load scale and travel indicators.
- All-steel welded construction meets pressure piping code.

For hanger installations which are subject to highly corrosive industrial conditions — or where exposed to severe weather, Grinnell makes available two distinct lines of pre-engineered spring hangers.

These hangers are the result of extensive experimentation with various coatings for Grinnell's standard pre-engineered spring hangers. In addition to providing flexibility in pipe suspension, they provide versatility of application through their corrosion-resistant characteristics.

1. NEOPRENE COATED — for highly corrosive conditions, such as those found in chemical plants and refineries. All parts of the hanger are neoprene coated to protect the base metal from a wide range of corrosives. The flex life of the spring is unaffected by the neoprene . . . the coating resists cracking or flaking over a wide temperature range.

2. GALVANIZED — for outdoor installations, where weather conditions are severe. All parts of the hanger are galvanized except the spring, which is neoprene coated to avoid alterations of temper, hydrogen embrittlement and decreased flex-life of the spring — usual hazards to springs from the galvanizing process. Write for further details.

GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

DeBOTHEZAT FANS

PERFORMANCE RATING BOND

$250,000.00 No. 250

GUARANTEE

All new DeBothezat standard fan units are guaranteed:

1. To perform in accordance with their current published ratings. These ratings cover the performance of the completely assembled fan unit.
2. To be free from defects in material and workmanship.

DeBOTHEZAT FANS DIVISION WILL CORRECT OR REPLACE ANY SUCH FAN UNIT WHICH IS DEFECTIVE AND DOES NOT PERFORM IN ACCORDANCE WITH ITS PUBLISHED RATING FOR A PERIOD OF ONE YEAR FROM DATE OF SHIPMENT TO BUYER, SUBJECT TO THE TERMS AND CONDITIONS OF SALE.

DeBOTHEZAT FANS DIVISION OF
AMERICAN MACHINE AND METALS, INC.

BY

Vice President

AMERICAN MACHINE AND METALS INC. INCORPORATED 1930 DELAWARE

AMERICAN SURETY COMPANY OF NEW YORK

BOND

This is to certify that the above guarantee is bonded by AMERICAN SURETY COMPANY OF NEW YORK, with principal office at 100 Broadway, New York, New York, (hereinafter called "Surety") under bond deposited with NEW YORK TRUST COMPANY, 100 Broadway, New York, New York, [illegible] of Buyers of [illegible] DeBOTHEZAT standard fan units guaranteed [illegible] INC., will [illegible] FANS DIVISION [illegible]

Facsimile of actual PERFORMANCE BOND behind DeBothezat fan ratings. Bond on deposit with New York Trust Company, New York.

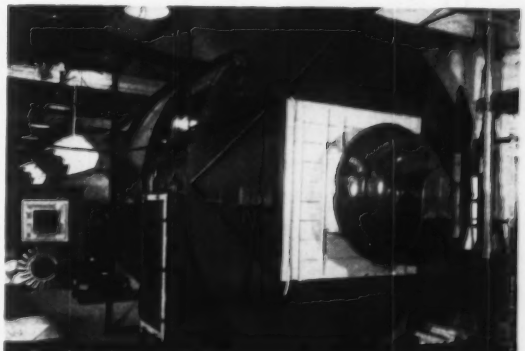
now . . . Bonded Fan Ratings

You can depend upon all DeBothezat fan ratings because they are *bonded*. When you select a DeBothezat fan by its published rating, do so with confidence. No guesswork — no allowance to be on the safe side.

All DeBothezat fan performance ratings are *bonded* by the American Surety Company and this bond is on deposit with New York Trust Company, New York.

This is your positive assurance that a DeBothezat rating is what the *complete* fan unit actually puts out.

Remember, you can depend on DeBothezat fan ratings because they're BONDED.



Partial view of DeBothezat's own advanced testing facilities. Accurate wind tunnel tests are made here in accordance with the appropriate NAFM plate . . . conform to U. S. Dept. of Commerce Standard 178-51.

Copyright 1957

De Bothezat FANS

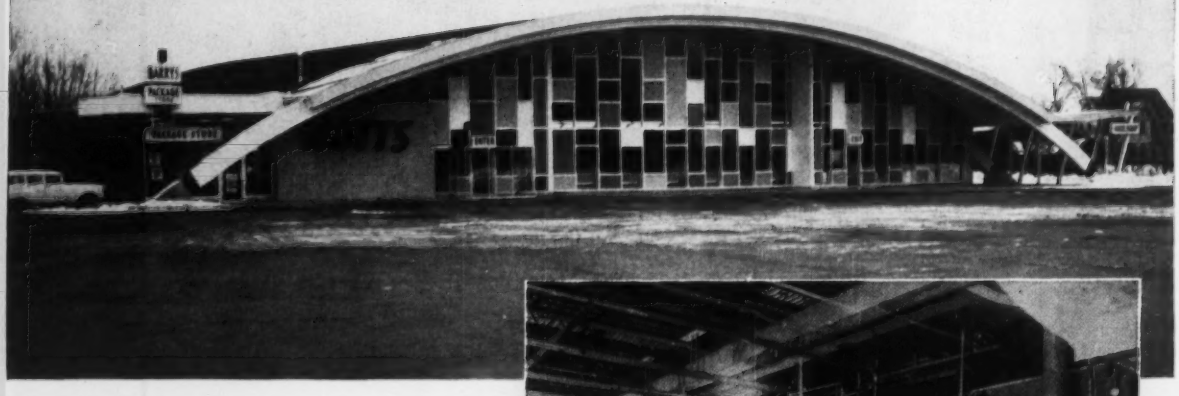
A DIVISION OF

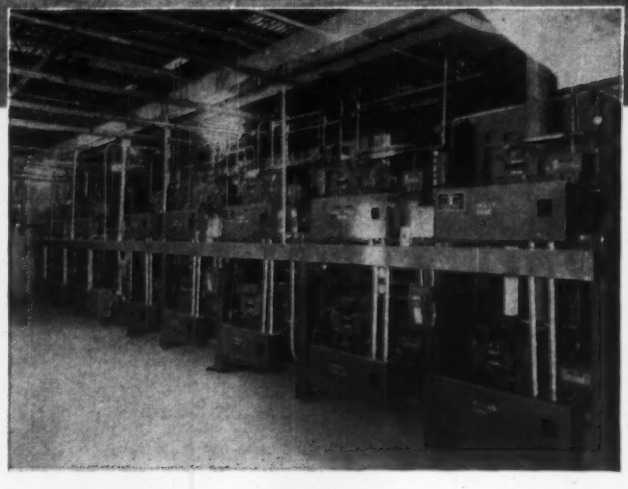
American Machine and Metals, Inc.

DEPT. HP-957, EAST MOLINE, ILLINOIS

IN CANADA: Represented by DOUGLAS ENGINEERING CO., Ltd., Toronto • Montreal

HERE BRUNNER-METICS 'RACK-UP' IMPORTANT SPACE SAVINGS





HERE, at Mott's, one of New England's newest and grandest supermarkets, Brunner-Metic equipment makes the difference . . . in space-saving, money-saving convenience . . . supplying the optimum in refrigeration.

Twenty-three Brunner-Metic Condensing units, efficiently arranged in twelve space-saving racks, positively assure proper refrigeration of dairy, meat and produce walk-in boxes, the freezer and meat cutting rooms, and the many frozen food cases, in all of which the demands for certain temperature levels are both constant and different.

Brunner-Metics, products of Dunham-Bush, the company that serves supermarkets throughout the nation with high quality equipment for heating, cooling and refrigeration, can "Rack-up" important savings for *you*. Write today for complete information.

Dunham-Bush, Inc.

WEST HARTFORD 10 • CONNECTICUT • U. S. A.

DUNHAM-BUSH

AIR CONDITIONING • REFRIGERATION • HEATING • HEAT TRANSFER

Heating Piping & Air Conditioning

Vol. 30, No. 9

(With which is merged the Aerologist)

for CONSULTING ENGINEERS, MECHANICAL (heating, piping, and air conditioning) CONTRACTORS, and ENGINEERS WITH PLANTS AND BIG BUILDINGS

Board of Consulting and Contributing Editors . . . .

N. R. Bernz, John E. Brock, Leo F. Collins, Sabin Crocker, Philip Drinker, M. K. Fahnestock, Walter L. Fleisher, William Goodman, William A. Hanley, G. W. Hauck, E. P. Heckel, R. E. Hieronymus, John A. Holbrook, Lee P. Hynes, C. W. Kimball, A. C. Kirkwood, Charles S. Leopold, Samuel R. Lewis, H. C. Murphy, Alfred J. Offner, Lester S. Ries, K. E. Robinson, F. B. Rowley, Robert P. Schoenijahn, Kalman Steiner, T. S. Tenney, Rush D. Touton, Eph A. Tyler.

Editorial Director ..... C. M. Burnam, Jr.

Editor ..... Robert W. Roose

Associate Editor ..... John B. Stoner, Jr.

Associate Editor ..... Bruce A. Cook

Editorial Assistant ..... Mary E. Holligan

Advertising Staff . . . . Wallace J. Osborn, Robert J. Osborn, and Richard G. Osborn, New York—Murray Hill 9-8293 . . . . Robert A. Jack and Donald T. Brickner, Cleveland—Superior 1-1291 . . . George C. Cutler, Thomas V. Johnson, and John T. Hughes, Chicago—State 2-6916 . . . . James D. Thomas, Tucson—East 6-3698 . . . . Bob Wettstein, Los Angeles—Dunkirk 8-2286, Portland—Capitol 8-4107, San Francisco—Yukon 2-9537.

President & General Manager ..... Chas. E. Price

Circulation Director ..... Frank S. Easter

Production Manager ..... Lawrence A. Doyle

Published monthly by the Keeney Publishing Co., 6 N. Michigan Ave., Chicago 2, Ill. Telephone: STate 2-6916. Subscriptions: U.S. and possessions, $3.00 per year; Canada, Cuba, Mexico, Central America, South America, $4.00 per year; other, $6.00. Current copies, 75c each; back copies, $1.00 each. January 1958 issue $2.00 per copy. Member Audit Bureau of Circulations, Associated Business Publications, Inc., and Magazine Publishers Association, Inc. Heating, Piping & Air Conditioning is indexed regularly by Engineering Index, Inc., and Industrial Arts Index and is microfilmed by University Microfilms.

©1958 by the Keeney Publishing Co.

Entered as Second Class Matter May 18, 1929, at the Post Office at Chicago, Ill., U.S.A. under the Act of March 3, 1879. Additional entry at Mendota, Ill.

SUBSCRIBERS—*Change of Address*: Publisher needs five weeks' advance notice, mail address from current issue envelope, and new address with city postal zone number. Mail to . . . Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill., U. S. A.

POSTMASTER: *When Magazine Is Undeliverable*: Send Form 3579 to Publisher at above address. Include city postal zone AND DATE *on last line* under mail address on envelope as our *key*.

September 1958

FEATURES

Jet Fuel Piping Delivers 1200 Gpm to "Stratofort" 113
R. H. Schairer

Hospital's Air Conditioning Maintenance Assures Optimum Operation 117
Daniel M. Roop

NDHA Hears Technical Committee Reports 121
John F. Collins, Jr.

Industrial Ventilation: How Are Built-up Systems Designed? 125
John H. Clarke

Advanced Approach Simplifies Piping Flexibility Analysis 130
Edwin A. Wert

Combination of Several Systems Solves School's Heating Riddle 134
John G. Skidmore

Air Raid Shelter Ventilation Designed for Atomic War Emergency 136
Axel Rosell

New Toll Plaza Snow Melting System Keeps Skyway Traffic Moving .. 140
Gordon W. Neal

Installations Show How Gas Engines Drive Air Conditioning Systems . 144
Robert S. Curl and Robert C. Marsh

Engineers Probe Management Problems 148
Harry J. Scharres

The Law and Your Profits 149
Sound contract stands up in court

DATA SHEET

How to Figure Duct Fitting Losses 151
James A. Hodde

ASHAE JOURNAL SECTION

Air Cooled Condensers 155
Otto J. Nussbaum

Block and Pipe Insulations 161
Ray B. Crepps

Thermal Conductivity Measurement of Dry and Moist Materials 163
W. Woodside

Frost Formation and Heat Transfer on a Cylinder Surface 171
P. M. Chung and A. B. Algren

For complete Journal Section table of contents see page 153

DEPARTMENTS

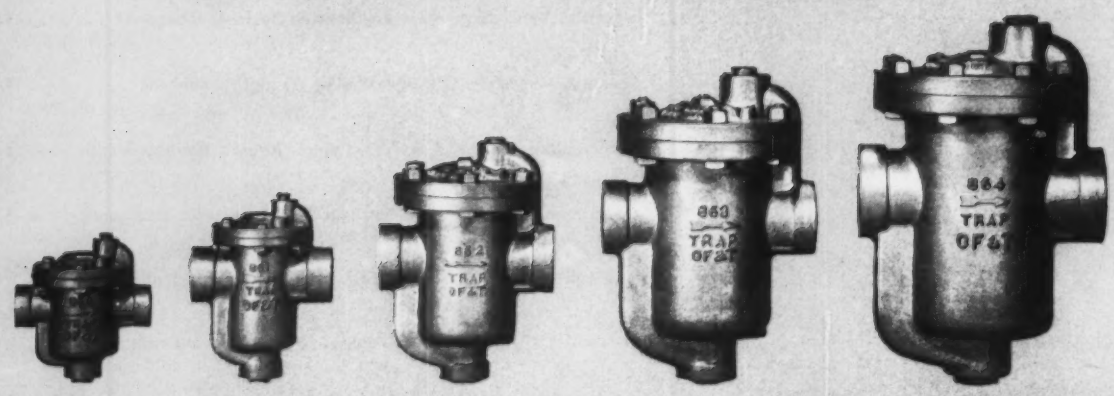
The Editors' Pages	93	Who's What	274
"Open for Discussion"	97	In the Territories	280
Question of the Month	104	We Hear That	290
Equipment Developments	205	Meetings and Conventions	294
Recent Trade Literature	252	New Books and Reports	300

Index to Advertisers 304

Front cover photo courtesy The Seattle Times

ANNOUNCING a Complete New Line . . .

ARMSTRONG Open Float and Thermostatic Steam Traps



860 (¾") 861 (1") 862 (1¼") 863 (1½") 864 (2")

Designed and Made by Armstrong Especially for Low Pressure Heating Service

■ Armstrong Open Float and Thermostatic Traps are the result of the demand by user-owners and contractors for an effective, trouble-free steam trap for heating service.

How They Work

When the steam is first turned on, Armstrong O.F.&T. traps quickly vent the air that has accumulated in the heating units. After start-up, the traps will vent air and CO_2 gas at steam temperature to prevent corrosion of unit heater tubes and other types of finned radiation. Condensate is removed as fast as it accumulates without loss of steam.

Advantages of Armstrong O. F. & T. Traps

The design and construction of Armstrong Open Float and Thermostatic Steam Traps provides outstanding benefits to both the owner and the installing contractor:

LOW COST is made possible by simple, compact design and large volume production.

EASY INSTALLATION. Pipe connections are horizontal and opposite. Traps are supported by the connecting pipes.

INTERNAL CHECK VALVES of 18-8 stainless steel can be furnished with the traps to save cost of installing external check valves.

YEARS OF SERVICE LIFE . . . Working parts are all stainless steel, highly resistant to both corrosion and wear.

MINIMUM MAINTENANCE . . . comes not only from the use of stainless steel parts, but also because the trap is self-scrubbing. Ordinary sediment and sludge are washed right through with the condensate.

Further Information Available

If a trap with these features is of interest to you, get in touch with your nearby Armstrong Representative. Ask him for Bulletin 775 which gives price, dimension and capacity data, or use the coupon below.

ARMSTRONG MACHINE WORKS
8749 Maple Street • Three Rivers, Michigan

FREE BULLETIN
No. 775 gives detailed information on Armstrong O.F.&T. traps.

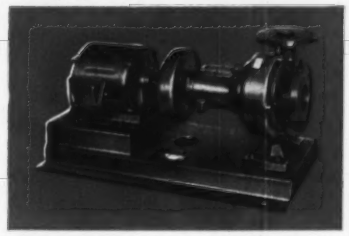
ARMSTRONG MACHINE WORKS
8749 Maple Street, Three Rivers, Michigan
Please send a copy of Bulletin No. 775.

Name_____
Company_____
Street Address_____
City_____ Zone____ State_____

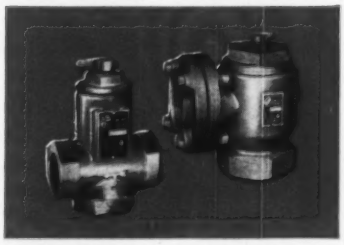
Hydro-Flo PRODUCTS

THE WORLD'S MOST COMPLETE LINE OF HYDRONIC* EQUIPMENT

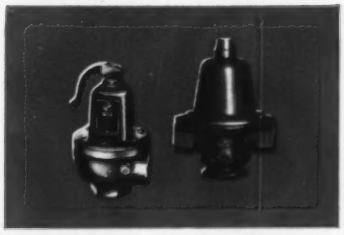
B&G Boosters



B&G Universal Pumps

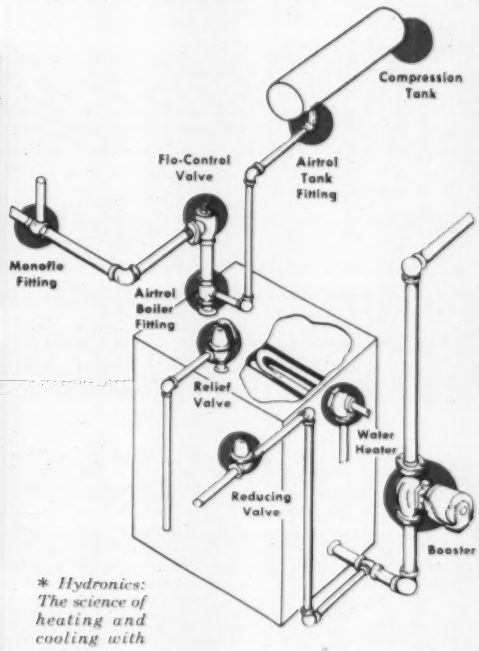


B&G Flo Controls



B&G Relief and Reducing Valves

B&G Airtrol Systems

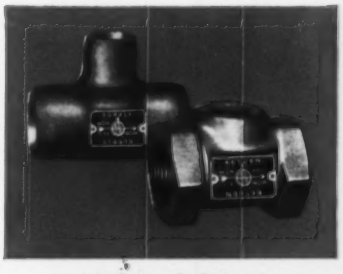


* *Hydronics: The science of heating and cooling with water.*

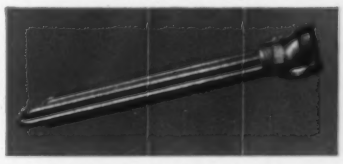
The B&G emblem has become known as a symbol of quality...a natural result of continuous effort to improve product and service.

B&G *Hydro-Flo* Products for hydronic systems measure up completely to the standards by which every intelligent dealer judges the equipment he recommends and sells, namely, *good product, adequate service facilities, manufacturing responsibility and consumer acceptance!*

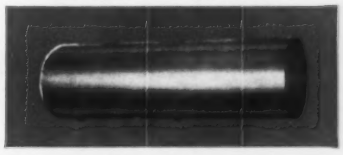
A circulated water system, for heating and cooling, when equipped with B&G *Hydro-Flo* Products throughout, offers all the advantages of a completely integrated installation of highest quality equipment, carrying a single manufacturer's guarantee.



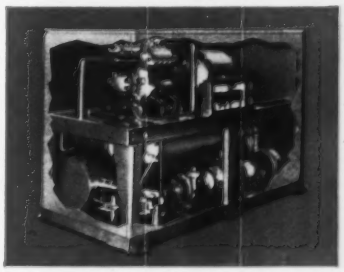
B&G Monoflo Fittings



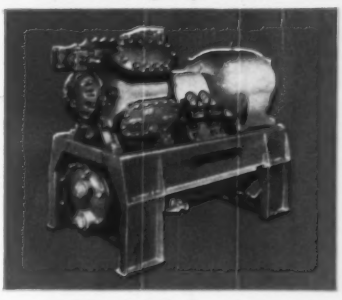
B&G Indirect Water Heaters



B&G Compression Tanks



B&G Package Liquid Coolers



B&G Condensing Units

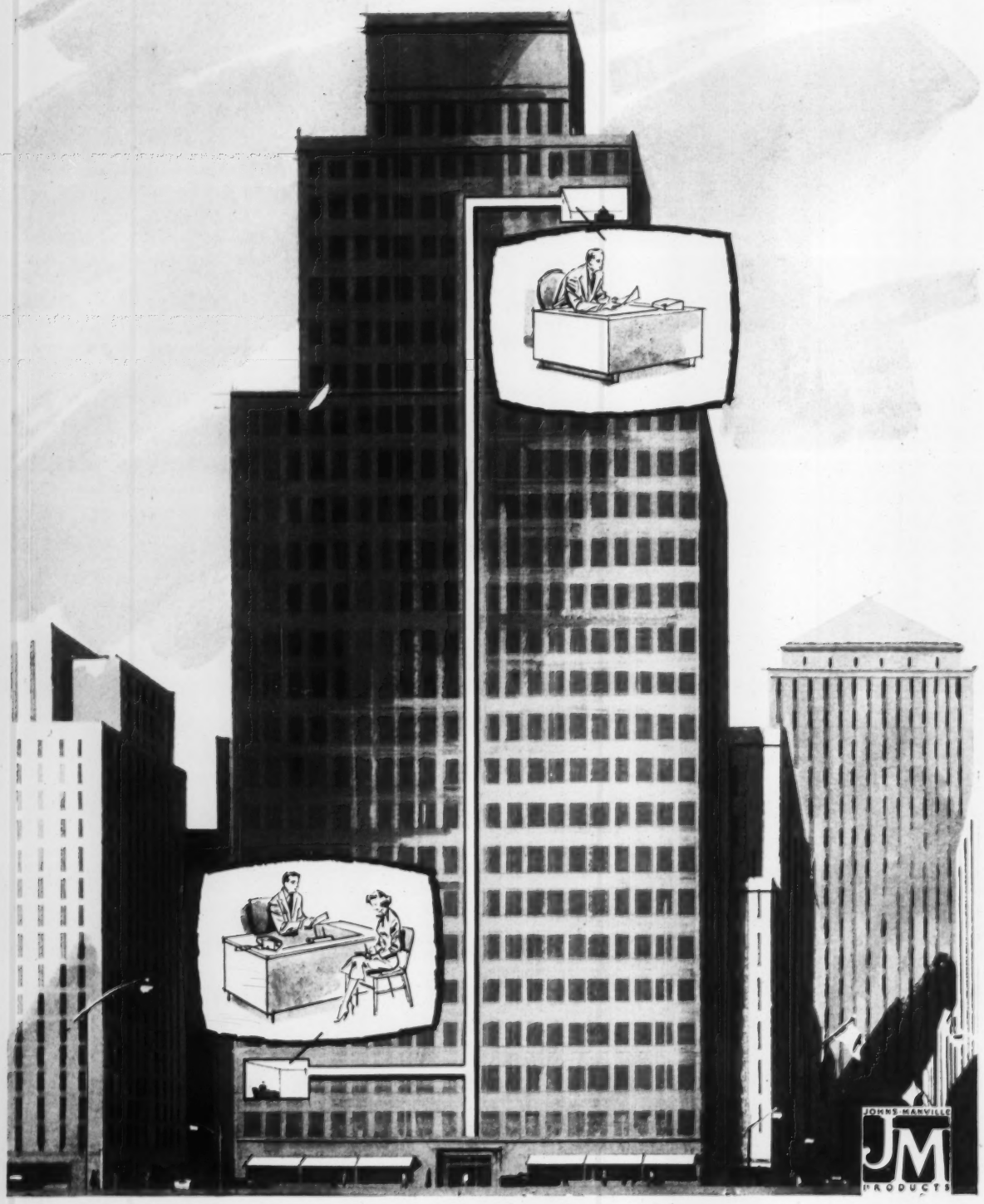
Reg. U.S. Pat. Off.

BELL & GOSSETT
COMPANY

Dept. FK-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

Mr. Smith is 600 duct feet farther from



the fan room than Mr. Jones, yet . . .

both men work comfortably at the same temperature!

when ducts are *fitted square and tight* with Johns-Manville semi-rigid Spintex Insulation

SEMI-RIGID SPINTEX® works two ways to lessen heat loss, stop condensation: first, with low conductivity . . . then, with its square, tight fit. The structural strength of this material, which is fastened snugly to duct surfaces with pins and clips, prevents "ballooning" due to duct leakage. And butted or mitred joints eliminate stretching and thinning of the insulation at corners. Instead, there's a full thickness of Spintex—with full protection against heat loss and condensation—over the *entire duct area.*

This two-way "edge" in insulating effectiveness is the big reason why leading engineers everywhere specify semi-rigid Spintex . . . for factories, institutions and office buildings of every description.

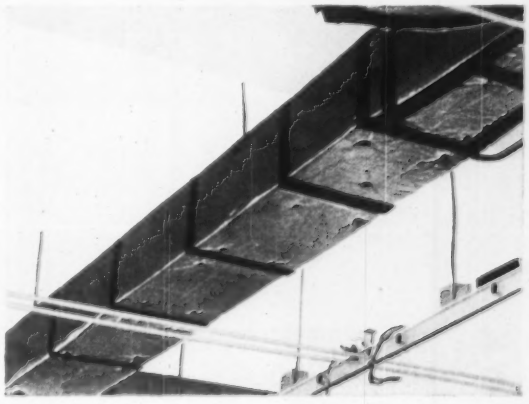
LESS HEAT LOSS...NO CONDENSATION AT CORNERS!
Semi-rigid (not flexible) Spintex fits squarely and tightly all duct surfaces. Stretching and thinning at corners, unavoidable with wrap-around insulations, are eliminated completely. Instead, Spintex retains full thickness everywhere to stop heat loss and condensation. Its structural strength prevents "ballooning."

FACED FOR ANY SPECIALIZED NEED!
J-M offers you a facing to meet any vapor condition, incombustibility requirement or decorative need. Provides good base for plaster finish . . . or where no facing is indicated, Spintex presents an attractive appearance with trim, tidy joints.

INSTALLS QUICKLY . . . ECONOMICALLY.
Spintex is clean, sanitary and "friendly" to handle. It cuts readily with an ordinary knife. Installs quickly, easily, even when ducts are curved or in difficult-to-reach areas.

Produced by a new Johns-Manville spinning process, today's Spintex offers more insulating value than ever. Its mineral fibers are smaller in diameter, and substantially more uniform. This improved fibrous structure adds countless heat-blocking dead-air spaces per cubic inch to help keep working temperatures precisely the same throughout the structure . . . with minimum operating costs!

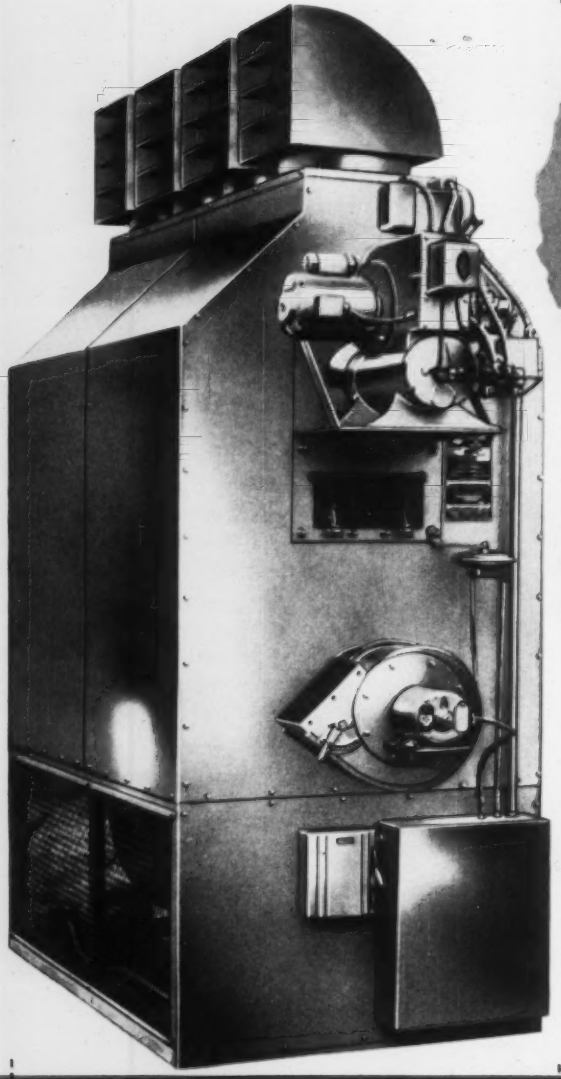
Your Johns-Manville sales representative will be pleased to send you information, along with samples of Spintex and J-M facing materials. Why not call him today. Or write Johns-Manville, Box 14, New York 16, N. Y. In Canada, 565 Lakeshore Road East, Port Credit, Ontario.

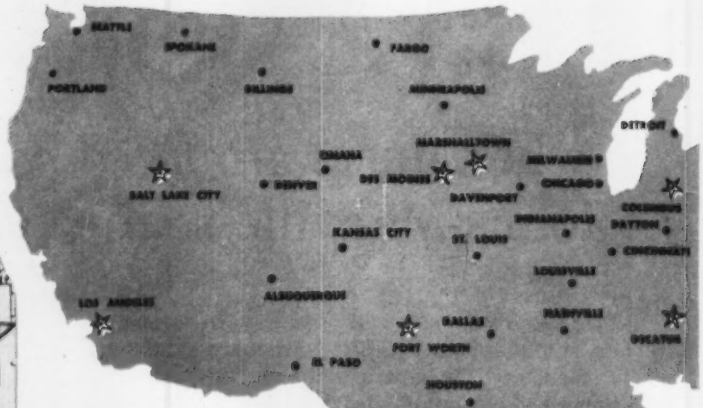


AIA FILE NO. 37-D-1-2

JOHNS-MANVILLE

LENNOX TEAMWORK on call for every INDUSTRIAL HEATING





Thirty-seven LENNOX sales representatives team up with factory personnel in 10 strategically located LENNOX plants — to supply *any* type industrial heating equipment you might require.

Only LENNOX, world leader in warm air heating, can put sales application facilities like these at your beck and call — at a moment's notice. You may be assured that your nearby LENNOX sales representative is, himself, a qualified heating specialist. He is wholly familiar with the modern concept of industrial warm air heating and air conditioning which your plant requires. The added resources of factory consultation make him the best qualified heating man you can contact.

Whatever your heating problems (see facing page), the six different Lennox "AT" Industrial Heater models, in 8 capacities, can meet your exact requirements—with greater economy and efficiency. Direct fired heaters from 400,000 to 2,000,000 Btuh . . . using oil, gas or combination fuel.

MAIL THIS COUPON today for full engineering details on Lennox heavy-duty *4-pass counter flow design* and other exclusive design benefits.

MAIL COUPON - - Today

LENNOX INDUSTRIES INC.
Industrial Division, Dept. HP-9
1701 East Euclid, Des Moines, Ia.

Please send me—without obligation—complete specifications and engineering data on Lennox AT series Industrial Heaters.

Name_____

Company_____

Address_____ City_____

Title_____

LENNOX Industries Inc.

INDUSTRIAL DIVISION · 1701 East Euclid

AIR CONDITIONING & HEATING

A typical "hot and cold" deck system of heating and air-conditioning uses a Lennox "AT" heat exchanger section in parallel with cooling coils to condition the atmosphere of this department store. Proportioning dampers and modulating burners on the "AT" units provide fuel economy and zone temperature control.

JOB

☆ Locates Lennox plants
● Locates Lennox sales representatives
(Canadian plants located at Toronto and Calgary.)

HEATING & VENTILATING

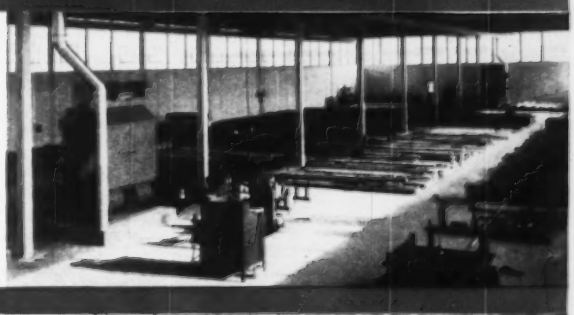
This food warehouse (with over 100,000 square feet of floor space, including a loading dock) is heated by five Lennox "AT" Industrial Heaters. Two of the heaters in the dock area blanket the loading doors with warm air, at the same time replacing the exhaust-laden atmosphere. Even temperatures are maintained throughout the building.

SPACE VENTILATION

One 2,000,000 Btuh Lennox "AT" Industrial Heater provides heating and ventilation for this large printing company. This single heater, equipped with modulating burner control and both fresh air and recirculating air dampers, provides economical heat and pure air for the printing area — where atmospheric conditions are vitally important to employees' health and productivity.

SPACE HEATING

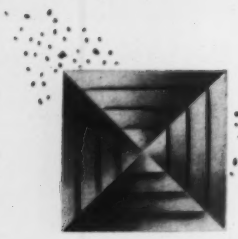
This steel warehouse with over 20,000 square feet of floor space is heated by two oil-burning Lennox "AT" Industrial heaters. Heated air is discharged at high velocity from directional nozzles above the heads of workers, providing a comfortable, even temperature in the working area, with minimum heat loss at ceiling level.



MAKE-UP AIR

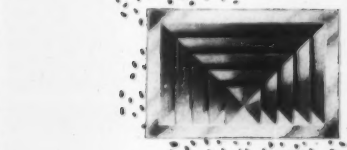
A typical installation uses two "AT" 175-G gas-to-gas heaters for make-up air in this 20,000 square foot factory where numerous paint booths with exhaust fans remove large quantities of contaminated air. Modulating burners conserve fuel—while proportioning dampers permit recirculation and provide fresh air for comfortable working conditions. Units remotely located.

· *Des Moines, Ia.*



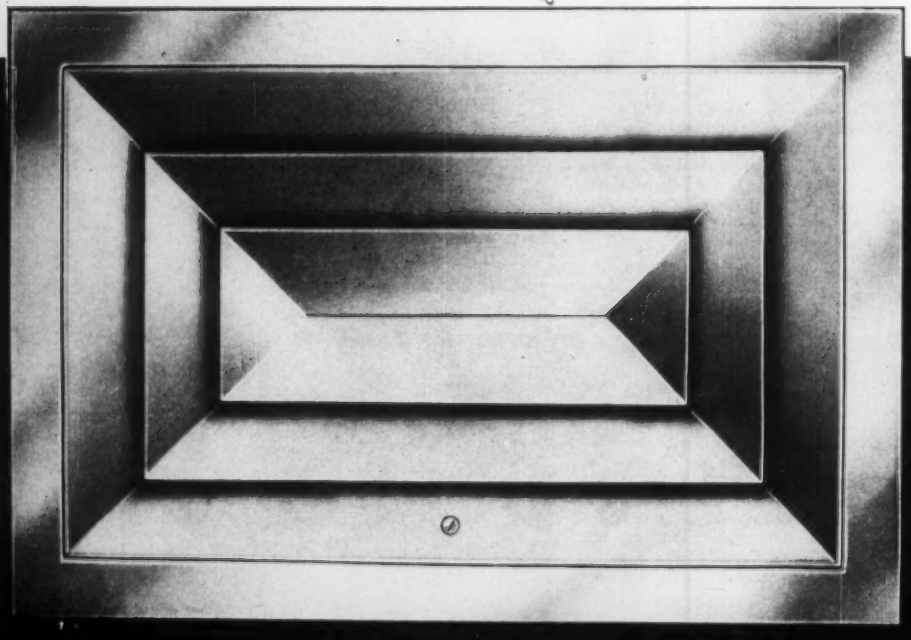
New

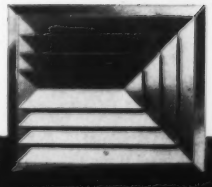
again... TITUS sets the "Pattern for Progress" in air conditioning with another tremendous new line...



UNLIMITED SELECTION OF DISTINCTIVE PATTERNS...

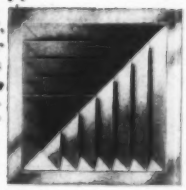
HANDLE OVERHEAD AIR *Gracefully* WITH PRECISION





series TMD square and rectangular air diffusers

designed by TITUS



Here's today's most beautiful new line of diffusers . . . for today's most beautiful ceilings. Their distinctive styling brings a crisp freshness of design to any interior . . . yet blends diffusers unobtrusively into any decor.

AND THERE'S PERFORMANCE TO MATCH THIS BEAUTY! New, ingenious, built-in vane and louver arrangements provide a level of air diffusion efficiency seldom equalled. *ACTUALLY GIVE ARCHITECTS AND ENGINEERS NEW DESIGN FREEDOM* because diffusers can be placed in nearly any ceiling location . . . without the use of baffles and blank-offs.

Series TMD diffusers are available in types, sizes, patterns to fit every conceivable ceiling installation . . . any shape or size space.

Furnished in 1-2-3 or 4-way air discharge patterns . . . *in an unlimited variety of core styles.* One-piece units and removable-core-units. Four distinct types of attractive mounting frames to fit any ceiling application.

Series TMD diffusers are supplied in a beautiful baked metalescent finish. *WRITE TODAY . . . learn how this amazing new Titus line can offer you new stimulating design opportunities.*

MAIL COUPON FOR NEW FREE 20-PAGE CATALOG

TITUS MFG. CORP., WATERLOO, IOWA

Rush me FREE ILLUSTRATED CATALOG that gives full information (including engineering data) on your exciting, completely new line of Series TMD diffusers.

Name

Company

Address

City State

ANNOUNCING

Die-Stamped "LAMINAIR-FLO"

Two-piece 90° Elbows

MACHINE MADE MASS PRODUCED

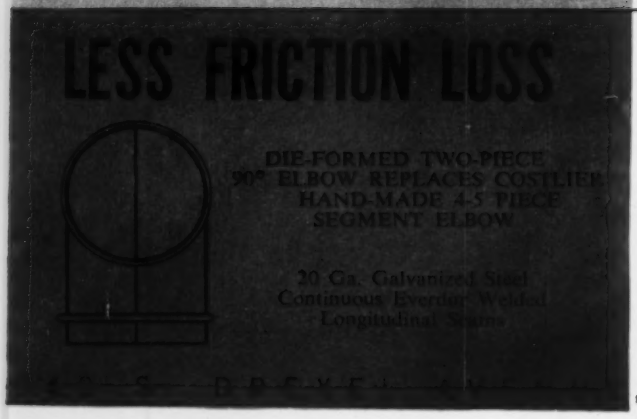
A NEW SMOOTHER PATH FOR HOT OR COLD AIR

Ideal For High Velocity Systems

- Reduced Static Head Loss
- Cold Forged In Precision Dies
- True Radii
- No Variations in Workmanship
- Uniform Consistent Data

A remarkable new concept in 90° elbows. Precision engineered, die-formed, longitudinal seam, two-piece elbows reduce friction loss considerably . . . systems are far more efficient. Production-line manufacturing reduces fabrication costs . . . elbows and fittings can be specified with a guaranteed uniform size and performance.

Complete Range of Uniform Size, Die-Stamped Elbows In 3", 4", 5", 6", 7", 8" Diameters


LESS FRICTION LOSS
DIE-FORMED TWO-PIECE 90° ELBOW REPLACES COSTLIER HAND-MADE 4-5 PIECE SEGMENT ELBOW
20 Ga. Galvanized Steel Continuous Evenpitch Welded Longitudinal Seams

Write To Division 88 For Price Information, Friction Loss Chart And New Engineering Test Data

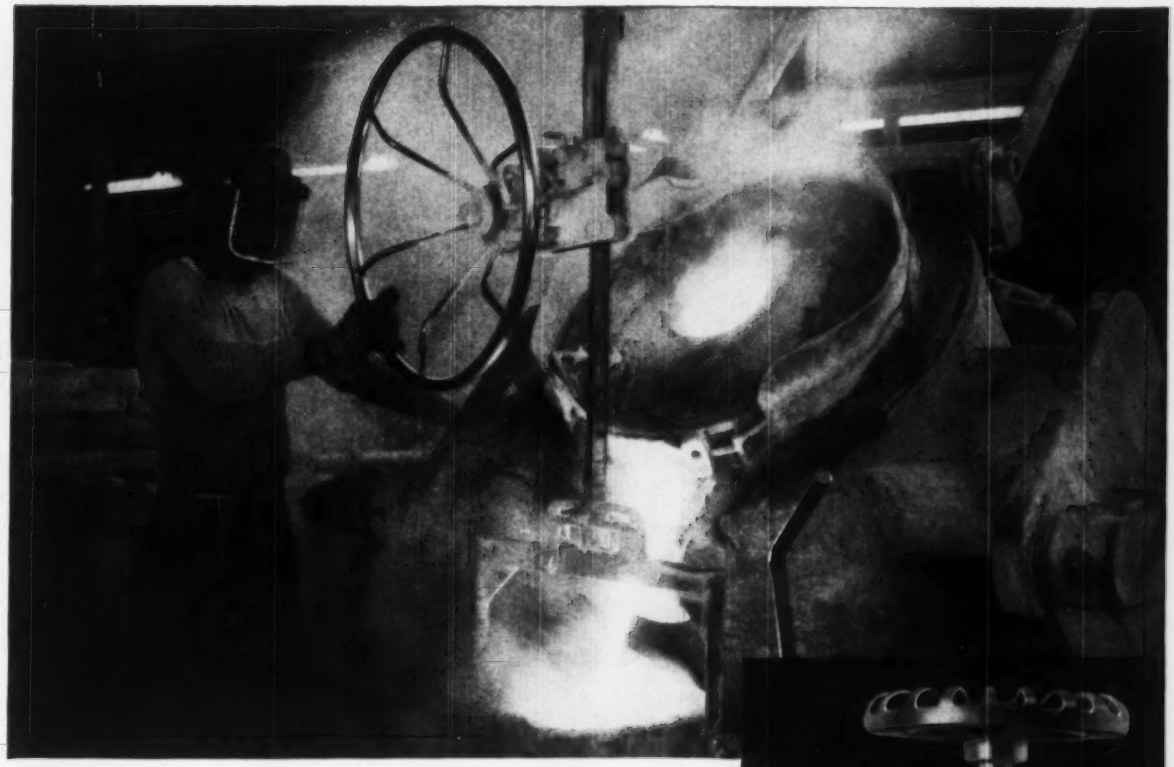
Another Advanced Design Product From

UNITED SHEET METAL CO., INC.

Representatives In Principal Cities In United States and Canada

, COLUMBUS 9, OHIO

PREMIUM QUALITY—MODERATELY PRICED



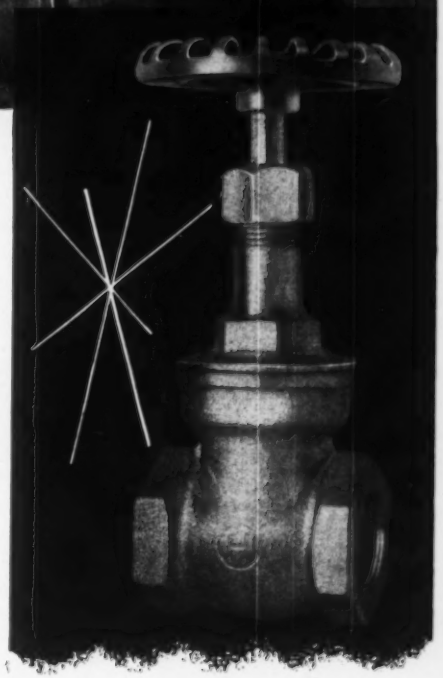
From virgin ingot to packaged valve-under one roof

At Hammond every step in the manufacture of bronze valves —from the melting of the certified bronze ingot down to final individual testing and packaging—is performed in one modern factory.

Each manufacturing step is conducted under rigorous controls to insure that every valve meets Hammond's reputation for quality second to none in the valve industry. Modern "automation" methods and high volume permit manufacturing economies which allow Hammond valves to be sold at moderate prices for valves of outstanding quality.

Hammond is one of the world's largest producers of bronze valves—and bronze valves are our only product. As such, they get the undivided attention of an outstanding engineering staff . . . are not relegated to a secondary position. Hammond engineers have developed over 550 different bronze valve designs . . . which means you can get a Hammond valve especially suited to your particular flow control requirements.

A new catalog No. 158, describes Hammond's complete line, contains valve number comparison charts and other engineering data. Write today to Hammond Brass Works, Hammond, Indiana.



Hammond Number 626 gate valve has rising stem, double wedge disc. Sturdily designed for heavy-duty industrial, commercial and original equipment application, to 150 lbs. steam, 300 lbs. w.o.g.

HAMMOND *BRITE-KOTE*® BRONZE VALVES

YOU JUST CAN'T FIND FINTUBE THAT'S EASIER TO INSTALL THAN THIS NEW SARCOFIN SILL TYPE RADIATION

New Sarcofin Sill Type Radiation, showing convenient peg-board element suspension

This new Sarcofin Custom Built Sill Type Radiation puts three important assets in your hands: high heating efficiency, great flexibility of application, and extreme ease of installation. The 16-gage steel cabinet is reinforced with strong, vertical supports welded at close intervals to the inside of enclosure to lend strength and rigidity to the entire assembly.

Rounded contours and precision flanges give smooth assembly, completely free of splicing plates and unsightly bolts. Peg-board element suspension means easy, fast mounting with end-to-end rigidity. Ample allowance for expansion and contraction.

Write for helpful Bulletins giving radiation data, pressure and temperature correction factors, and unit dimensions. Ask for:

No. 1660—Sarcofin Sill Type Radiation

No. 1650—Finned-Tube Commercial Radiation

No. 1640—Finned-Tube Baseboard Radiation

SARCO COMPANY, INC. • SARCOTHERM CONTROLS, INC.

635 Madison Avenue, New York 22, N. Y.

6151-B

"SPECIAL" Welding Fittings

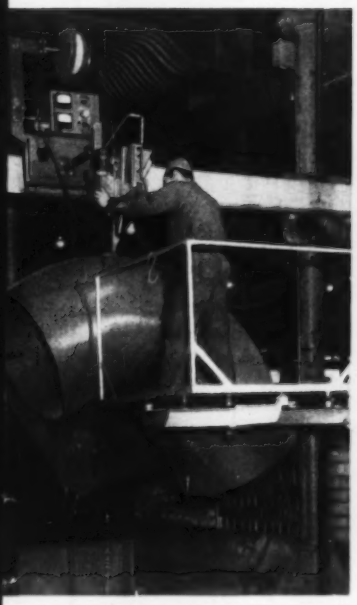
by MIDWEST

"SPECIAL" DESIGNS
"SPECIAL" MATERIALS
"SPECIAL" QUALITY
"SPECIAL" DELIVERY

Special gauges and instruments are used to make sure that we have complied with the extremely close tolerances often required on stainless fittings. Here wall thickness and concentricity were held within extremely close limits throughout the fittings.

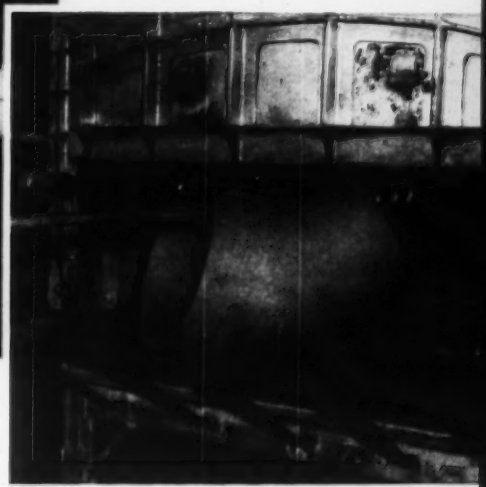
The exclusive Midwest method of manufacture—much more versatile and flexible than any other—enables us to make almost any type of special welding fittings to the most rigid specifications. Midwest makes welding fittings from *plate* . . . usually much easier to get than pipe, particularly if the material is special. That expedites delivery. Closer tolerances are inherent in the Midwest process, and quality control is always beyond code requirements.

Even if you use only standard fittings, the exceptional quality of Midwest fittings can be important to you. Ask your Midwest distributor or write us for new Bulletin 5801.



36" O.D. 90° elbow with 16" tangent on one end being welded by an automatic submerged arc machine. Material is A-201 carbon steel.

Stainless-clad elbows undergoing ultrasonic inspection to check bonding of material and quality of weld. Since plate is often the only form in which clad material is available, the Midwest process is able to produce the most comprehensive range of clad fittings—and to do so promptly.



Special 24" x 21" 45° reducing elbow made of 1" thick 1¼% chrome ½% moly steel ready for heat treating furnace.

MIDWEST PIPING COMPANY, INC.

Main Office: St. Louis 3, Mo. (P. O. Box 433)

PLANTS: ST. LOUIS, CLIFTON, N. J. and LOS ANGELES

SALES OFFICES:
Asheville (Box 446, Skyland, N.C.) • Atlanta 9—72 11th N.E.
Boston 27—426 First St. • Chicago 3—79 West Monroe St.
Cleveland 14—616 St. Clair • Houston 2—1213 Capitol
Los Angeles 33—520 Anderson • Miami 34—2103 Le Jeune
New York 7—50 Church St. • Pittsburgh 19, Pa.—437 Grant
San Francisco 11—420 Market St. • St. Louis 4, Mo.—1450 South Second St. • Tulsa—1640 E. 21st St.

STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

8059

NOW-

you can easily design an "MP" to solve YOUR air distribution problem

64 PAGES OF TABLES AND CHARTS DESIGNED TO SAVE YOU HOURS OF CALCULATING TIME

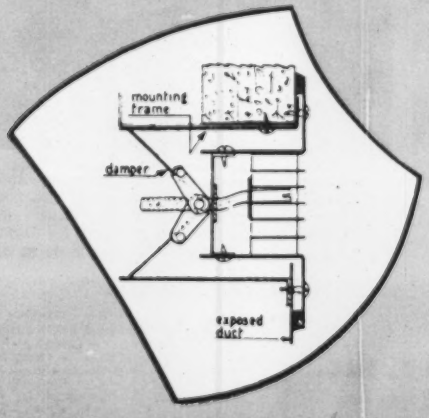
YOURS for the asking!

FLEXIFLO

LINE AIR

SPECIFIED FOR

- HIGH SIDE WALL
- AIR CURTAINS
- FLOOR AND CEILING
- SILL TOP

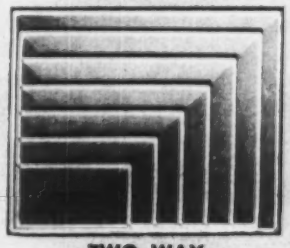


LINE-AIR can be installed on the wall or directly to the duct. Face operated dampers, operable every 24" are standard. Mounting frames are recommended for best installation.

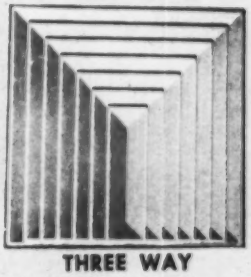
"MP" Multi-Pattern Air Diffusers

Custom made to suit all conditions

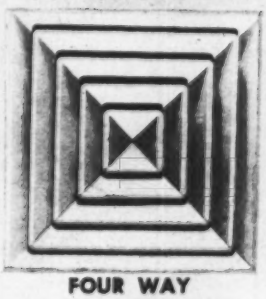
ONE WAY



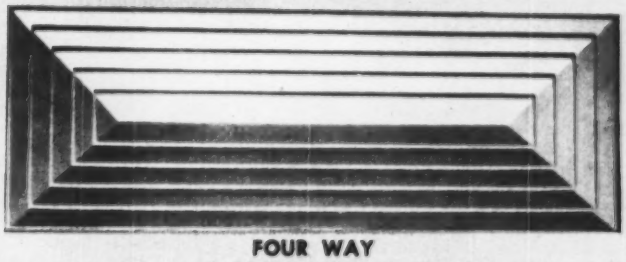
TWO WAY



THREE WAY



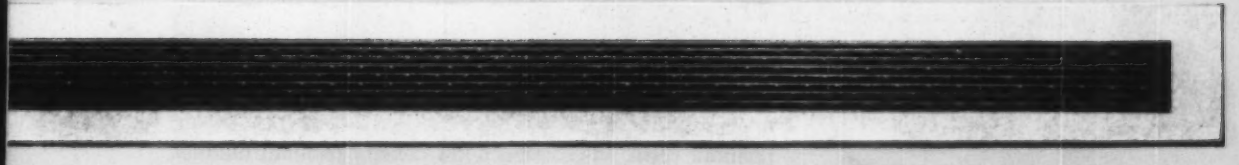
FOUR WAY

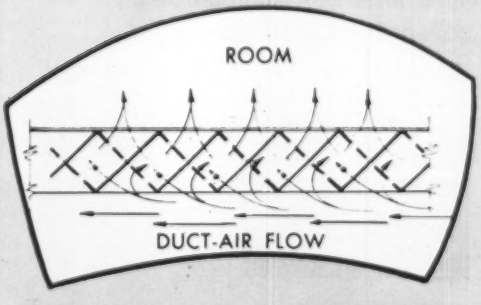


FOUR WAY

CONTINUOUS SLOT DIFFUSER

ANY WIDTH—ANY LENGTH





Showing how the air flowing longitudinally in a duct is diverted into the room through the LINE-AIR at a 90 degree angle without the aid of additional auxiliary straightening vanes.

Use this handy coupon

- ☐ Send "MP" Data Book
- ☐ Send complete product manuals
- ☐ Have representative call

Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....

FLEXIFLO

UNIVERSAL DIFFUSER CORP.
38 Marbledale Road, Tuckahoe, N. Y.

Sales offices in principal cities of United States and Canada

MICROTEX DUCT LINER HELPS PROVIDE HIGH EFFICIENCY IN NEW OFFICE BUILDINGS

Assures better working atmosphere for employees by absorbing fan and motor noises from new high velocity air conditioning system.

Here is an outstanding example of functional architectural design—the new Monsanto Chemical Company general offices in St. Louis.

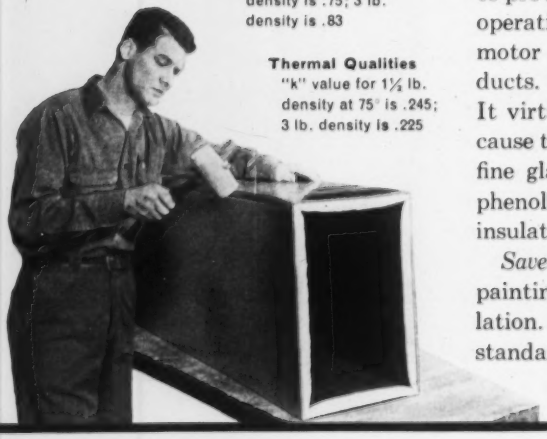
Architect: Vincent G. Kling.

Contractor: Fruin-Colnon Construction Company.

Insulation: L·O·F Glass Fibers' Microtex Duct Liner coated with black vinyl.

Sound Absorption
NRC for 1" liner, 1½ lb. density is .75; 3 lb. density is .83

Thermal Qualities
"k" value for 1½ lb. density at 75° is .245; 3 lb. density is .225



L·O·F Glass Fibers' Microtex Duct Liner was selected to provide the acoustical insulation necessary under peak operating velocities. *Reason:* Microtex absorbs fan and motor noises; soaks-up sounds transmitted through the ducts. Vinyl coating faces airstream: resists air erosion. It virtually eliminates the problem of condensation because the duct itself serves as a vapor barrier. Made from fine glass fibers bonded together with a thermosetting phenolic resin, Microtex is a low density resilient blanket insulation.

Saves Money, too. Ducts lined with Microtex need no painting inside, near grills or large registers, after installation. It is applied quickly without precision work using standard fabrication methods.

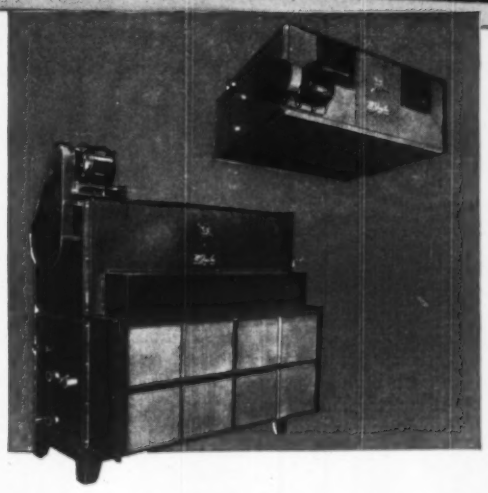
See how Microtex Duct Liner can help solve your insulation problems. Call or write the nearest L·O·F Glass Fibers' sales office or distributor.

L·O·F GLASS FIBERS

L·O·F GLASS FIBERS COMPANY • TOLEDO 1, OHIO

a Monument to PERSHING
a Monument to AIR CONDITIONING
BY McQuay

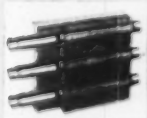
Pershing Municipal Auditorium, Lincoln, Neb.
Architects: Davis & Wilson, Lincoln
Consulting Engineer: William Cassell, Kansas City, Mo.
Mechanical Contractors: Natkin & Co., Lincoln.



The Pershing Municipal Auditorium is a showplace in Lincoln, Nebraska. It is a monument to General Pershing and a monument to air conditioning. Thirteen McQuay Seasonmaster units and ten McQuay water coils provide year 'round air conditioning for this modern structure. To be sure that your next air conditioning job functions at its very best, see your McQuay representative. He will be glad to assist you in any air conditioning heating or refrigeration problems you may have. McQuay, Inc., 1601 Broadway Street N. E., Minneapolis 13, Minnesota.

McQuay Horizontal and Vertical Seasonmaster central station air conditioning units. They are available with water coils, steam coils or direct expansion coils. Removable panels permit complete accessibility for inspection or service. All Seasonmaster units are made with the exclusive McQuay Ripple-Fin coils. Seventeen sizes available. Range from 640 cfm to 38,000 cfm.

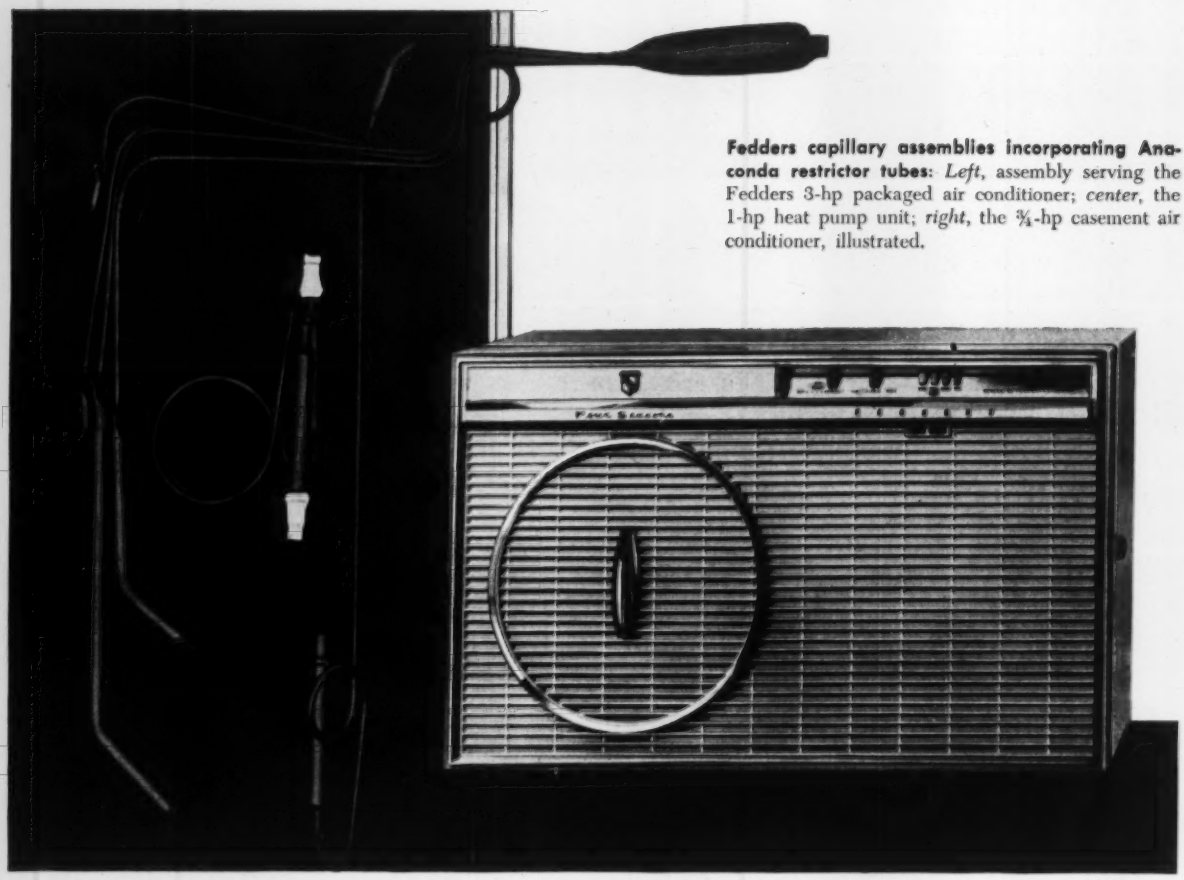
McQuay Means Quality



McQuay units feature the exclusive Ripple Fin Coils which create maximum air turbulence and have wide, full fin collars that act as automatic spacers to form a tube around the coil tube for greatest heat transfer and protection. Dura-Frame "V" channel construction provides the strength and rigidity necessary for quiet, trouble-free operation.

McQuay INC.

AIR CONDITIONING • HEATING • REFRIGERATION



Fedders capillary assemblies incorporating Anaconda restrictor tubes: *Left*, assembly serving the Fedders 3-hp packaged air conditioner; *center*, the 1-hp heat pump unit; *right*, the ¾-hp casement air conditioner, illustrated.

"We use Anaconda Restrictor Tube 100%" –Fedders-Quigan Corp.

As one of the largest producers of room air conditioners, Fedders-Quigan Corporation, Maspeth, Long Island, uses miles of restrictor tube a year. Since 1954, Fedders has been using only Anaconda Restrictor Tube.

Fedders looks on the restrictor tube as the jugular vein of the air conditioner. The faithful performance of the entire unit depends largely on the tube's uniformity and quality. Fedders looks for these qualities in restrictor tubes:

1. Uniform performance within extremely close air-flow limits, made possible by consistently uniform inside diameter and a smooth, round, clean bore.
2. Easy bending, without fractures.

Fedders uses restrictor tube in four inside diameters in six lengths, reordering from Master Sample Reference Tubes. Duplicate Master Reference Samples kept at French Small Tube Division, The American Brass Company, insure that all shipments have the air-flow limits originally established.

Consistently high quality. All Anaconda Restrictor Tubes are plug-drawn to finish. Every length is chamfered at both ends, inside and out. Each tube is thoroughly washed and dried, given a final air-flow test, carefully bundled, with ends of each bundle wrapped in paper. Anaconda Custom-Made Restrictor Tubes are made in both copper and aluminum, in nominal inside diameters from .025 to .090 inches.

Write for information or free Air-Flow Slide Rule Calculator. Address: French Small Tube Division, The American Brass Company, Box 1031, Waterbury 20, Conn. 6823

ANACONDA®

RESTRICTOR TUBES

Made by French Small Tube Division of The American Brass Company

ANACONDA PRODUCTS FOR THE REFRIGERATION AND AIR-CONDITIONING INDUSTRY

New Concept in Construction Fastening!

REMINGTON Power-Mate* BASIC UNIT

. . . plus choice of 4 interchangeable Stud Driver Kits

K-1. CAPTIVE STUD KIT—designed to prevent free flight of studs when base material is inadequate. Used with "Power-Mate," this is safest Stud Driver ever designed.

K-2. LIGHT-DUTY KIT—produces all-purpose tool. Handles 80% of your fastening in concrete or steel. K-1 and K-2 use ¼" diameter Remington Studs and 22 caliber Power Loads.

K-3. MEDIUM-DUTY KIT permits use of ⅜" diameter Remington Studs with low-cost 22 caliber Power Loads. This assembly gives top performance . . . economically.

K-4. MEDIUM- AND HEAVY-DUTY KIT for toughest fastening jobs. Designed for use with ⅜" diameter Remington Studs and scientifically graded 22 or 32 caliber Power Loads.

Most versatile tool ever designed for fastening wood or metal to concrete or steel

Now you can have the power you want, the stud size you need with the new Remington "Power-Mate." The tool is easy to use. Just a squeeze of the trigger is all it takes to anchor wood or metal sections to concrete or steel. No pre-drilling, no outside power connections required!

The Remington "Power-Mate" is flexible, too. Permits use of ¼" or ⅜" diameter alloy steel studs and 22 or 32 caliber Remington Power Loads to furnish driving force.

Take the "Power-Mate" Basic Unit, attach the Stud Driver Kit of your choice—and the tool is ready to use! It will handle any fastening job—light, medium or heavy duty. That's why the Remington Stud Driver is the most versatile construction fastening tool ever designed!

Remington® DUPONT

STUD DRIVER

*"POWER-MATE" is a trademark of Remington Arms Company, Inc.

Remington Arms Company, Inc.
Industrial Sales Division, Dept. HP-9
Bridgeport 2, Connecticut

Please send free booklet on the Remington "Power-Mate."

☐ I am especially interested in the Captive Stud Kit.

Name .....

Firm ..... *Title* .....

Address .....

City ..... *State* .....

This cooling tower had to be

It had to be an UNDERFLOW®

AQUATOWER

In many cases, there is little choice in the location of the cooling tower—and when it must be placed in the midst of a group of hospital buildings, sound level is of paramount importance.

The successful solution to this problem for a midwestern hospital was the installation of Marley's new UNDERFLOW — the *completely enclosed*, low-silhouette cooling tower for intermediate-capacity requirements. "This tower just whispers," says the operating engineer, "and there is no disturbing noise in operating or patient rooms—just several feet from the tower."

In UNDERFLOW design, the fan and mechanical equipment are located *beneath* the tower and force air upward into a plenum chamber from which it is diverted horizontally into dual cooling chambers, then discharged vertically at two sides of the tower. This design innovation baffles fan noise and still permits use of gravity distribution of water, cross-flow air-water contact, close-packed fill, and other features that have made Marley intermediate-capacity cooling towers the world's most popular.

Because it is completely enclosed, UNDERFLOW, more than any other tower, blends inconspicuously with any architecture. It is the only tower designed to conceal fan, mechanical equipment, air intake area—even piping. To get the information the tower itself conceals, contact the Marley sales engineer in your city — or...

WRITE FOR BULLETIN UA-58

U. S. and Foreign patents pending—all rights reserved.

MARLEY

The Marley Company **Kansas City, Missouri**

Like money in your pocket!

BRIDGEPORT COPPER Drainage Tube DWV

SAVES MONEY · SAVES INSTALLATION TIME
SAVES LABOR

Money Saving! You'll save as much as $50 per house with Bridgeport Copper Drainage Tube DWV. It goes in faster with less labor and fewer tools and fittings.

Time Saving! Using Bridgeport DWV in place of other materials cuts installation time at least 50%. It's quickly and easily cut to size. Simple-to-make solder joints eliminate the need for time-consuming threading, caulking and leading. And, since it's furnished in standard 20 ft. lengths, you can plan on longer runs, fewer joints.

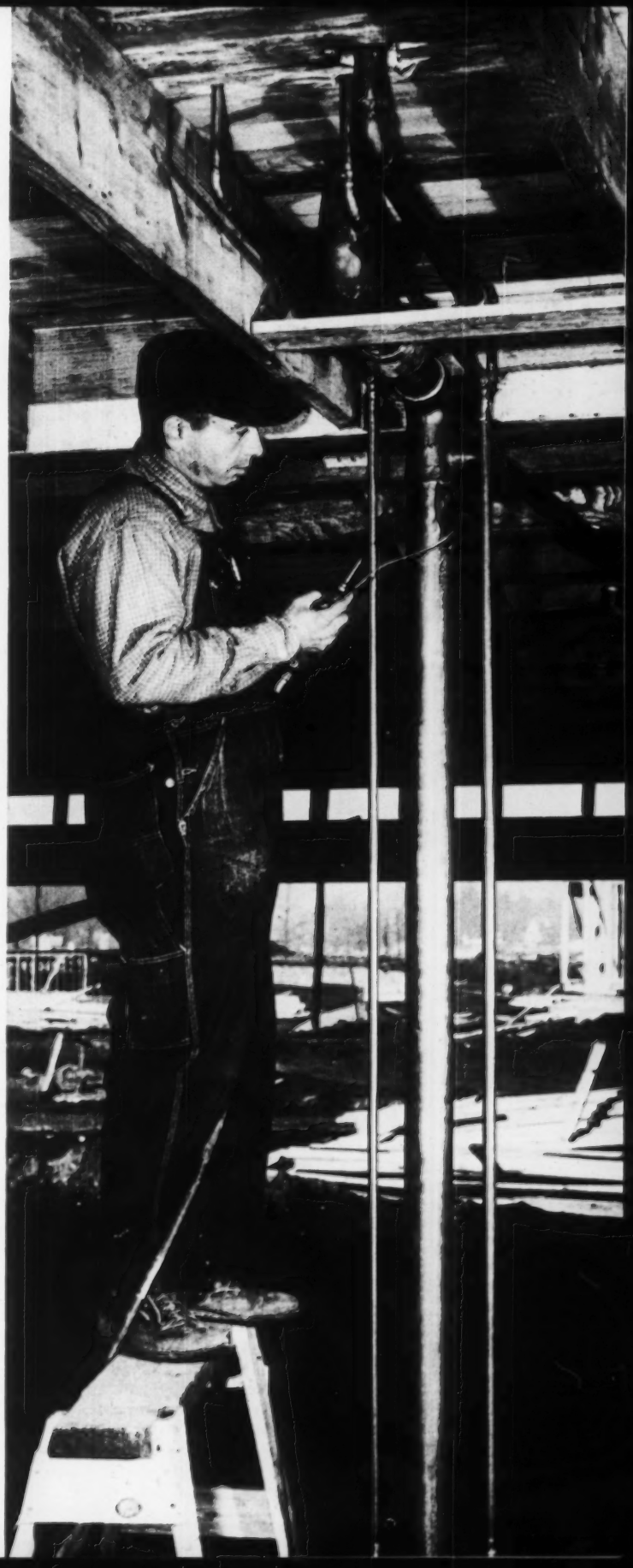
Labor Saving! Bridgeport Copper DWV is easy to handle—weighs only ⅓ as much as other materials. In fact, 20 ft. of 3 in. DWV weighs only 34 pounds. And, the light weight and solid joints of a Bridgeport DWV tube assembly allow prefabrication in the shop or on the job—a big factor in keeping the work flowing smoothly and efficiently.

Cash in now on the BIG profit-boosting advantages of Bridgeport Copper Drainage Tube DWV. Use it on your next job. It's carried by leading wholesalers everywhere.

BRIDGEPORT COPPER TUBE

Bridgeport Brass Company, Bridgeport 2, Conn.
Sales Offices in Principal Cities
In Canada: Noranda Copper and Brass Limited, Montreal

BRASS Bridgeport CO.



Only Halstead & Mitchell offers a cooling tower with a 20-YEAR GUARANTEE

ON THE WETTED DECK
AGAINST FAILURE
DUE TO ROTTING
OR FUNGUS ATTACK

Here's why this is important: Fungus growth on cooling tower wood fill very often can accumulate to the extent that it actually obstructs air flow through the tower. This reduces tower capacity and affects performance of the refrigeration or air conditioning equipment involved. In severe cases, the wood will rot and cause tower failure.

Treated Deckings — For positive protection against such harmful effects, Halstead & Mitchell subjects the wood deck material used in all H&M cooling towers to a special, pressure creosote treatment. That's why *only* Halstead & Mitchell offers a 20-Year Guarantee on the wetted deck against failure due to rotting or attack by fungus. Original tower capacity is maintained, and that reliability is what cooling tower purchasers need.

Anti-Corrosion, Plastic Coatings — Halstead & Mitchell Cooling Towers have many other design features that increase tower life and keep maintenance costs to a minimum. For instance, the cooling tower casings are completely protected against corrosion by separate plastic coatings of Vinsynite, Vinyl Zinc Chromate, and chlorinated rubber, *after assembly*. Every edge, every corner, is sealed against rust.

Permanently Sealed Bearings — Another example, fan bearings are permanently lubricated and sealed. Damaging moisture is kept out. Maintenance and periodic greasing are eliminated.

H&M Cooling Towers are available in capacities of 2 thru 125 tons. Types include propeller fan, centrifugal fan and take-apart models. See your local wholesaler, or write for more information. Halstead & Mitchell, Bessemer Building, Pittsburgh 22, Pa.

HM Halstead & Mitchell

COOLING TOWERS · WATER-COOLED CONDENSERS
AIR-COOLED CONDENSERS · FINNED COILS

Fires heavy oil with light oil dependability

Burns any fuel oil through heaviest No. 5. The ability to fire either heavy or light oils and to modulate over a wide range are the two outstanding features that make the Micro-Mist burner unique in its field. An entirely new principle is employed in the two-stage atomizer that converts fuel oils, including heavy No. 5, to an air-oil fog that is readily ignited by an electric spark. No gas pilot required.

Look at these features. Models of Iron Fireman MicroMist burners are available for two important uses: as a component part of a boiler-burner unit (shown above) or as a conversion burner. They are as easily installed as a conventional gun type burner. No special boiler front or boiler pitting is required. Various grades of oil can be fired without burner readjustment, and with little more attention than a domestic oil burner. Heating of oil is required only in those cases where it is not sufficiently fluid for pumping.

Forced draft models available. Illustration above shows the compact, integral forced draft system for pressure sealed boilers. No high stack required.

Write for catalog and specifications

IRON FIREMAN®

AUTOMATIC FIRING EQUIPMENT

FOR HEATING, POWER, PROCESSING

IRON FIREMAN MANUFACTURING CO.
[illegible] W. 106th Street, Cleveland 11, Ohio
(In Canada, 80 Ward Street, Toronto, Ontario)

Please send me more information and specifications on the Iron Fireman MicroMist burner.

Name _____

Firm _____

Address _____

City _____ Zone _____ State _____

"That's a handsome ceiling . . . it's a pity you'll have to spoil it with air diffusers."

"That's where you're wrong! The diffusers are already in place . . . we're using completely concealed MULTI-VENT . . ."

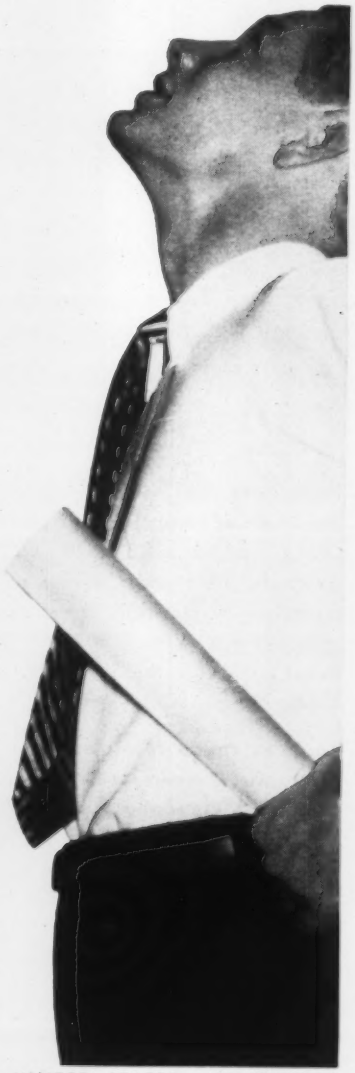
The integrity of a clean, attractive ceiling can be maintained unbroken when you work with Multi-Vent low velocity air diffusers.

Multi-Vent diffusers can be completely concealed. Nothing protrudes to create problems in symmetry or architectural effect.

This concealability provides still another advantage at a practical level: Partitions can be placed anywhere, and re-located at will with complete freedom. The Multi-Vent panels need not be moved, altered in any way, or even adjusted.

Multi-Vent introduces conditioned air through the perforations in standard acoustical ceiling pans, at low velocity. The air is gently diffused downward into the room. As a result, there is no "throw" or "blow" to bounce off partitions—which can actually bisect a Multi-Vent panel without affecting its function.

Write for detailed literature and name of representative in your area.



multi-vent

DIVISION OF
THE PYLE-NATIONAL COMPANY

1373 N. Kostner Avenue, Chicago 51, Illinois

WHERE QUALITY IS TRADITIONAL

SALES AND ENGINEERING REPRESENTATIVES IN PRINCIPAL CITIES OF THE UNITED STATES AND CANADA

new SUPER/AIR-VAN®

in FIBERGLAS

INHERENTLY QUIET
SONOSOLVE HOOD
NEVER NEEDS PAINTING
CORROSION RESISTANT
LIGHTWEIGHT
STRONGER THAN STEEL
LOW INITIAL COST
LOW SILHOUETTE
PATENTED SCROLL DESIGN
PATENTED AIR SEAL OFF

AVAILABLE IN ANY COLOR

The Gallaher Company 4108 Dodge Street Omaha, Nebraska

More than 100,000 Gallaher Air-Vans Have Been Installed.

*TM Owens-Corning Fiberglas Corporation

U. S. Pats. 2188741, 2526290 Pats. Pending

CONNOR

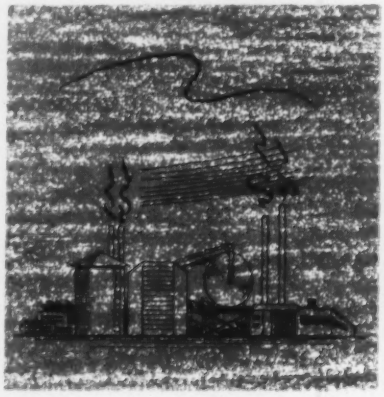
dorex®

Meets Every Demand for PROPER AIR PURIFICATION

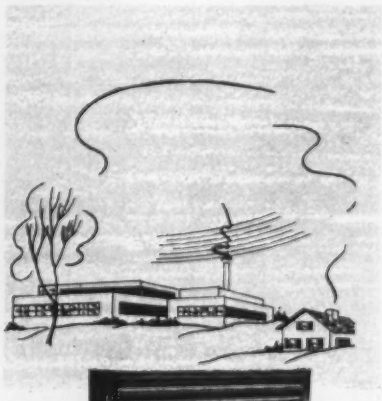
the most complete line of Air Purification equipment available

1—PURIFIES COMBINED RECIRCULATED AND OUTSIDE AIR

2—PURIFIES SEVERELY CONTAMINATED INDUSTRIAL OUTSIDE AIR



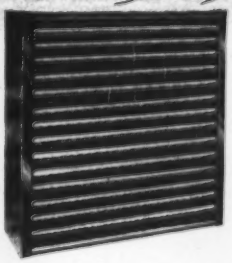
3—PURIFIES COMMERCIALLY CONTAMINATED OUTSIDE AIR (SMOG)



SPECIFICATIONS			
	No. 28	**No. 42**	**No. 52**
Size (Face Dimensions)	24" x 24"	24" x 24"	24" x 24"
Depth (in dir. of Air Flow)	8¾"	8¾"	8¾"
Maximum Capacity	1000 CFM	700 CFM	1000 CFM
Carbon Bed Thickness	½"	¾"	½"
Approx. Weight of Carbon	36 lbs.	45 lbs.	45 lbs.
Resistance*	0.225" WG	0.285" WG	0.24" WG
Efficiency	95%	95%	95%
Net Weight (cell only)	87 lbs.	92 lbs.	97 lbs.
Shipping Weight	110 lbs.	115 lbs.	120 lbs.

*The resistance of Dorex C Cells will not vary provided they are protected against dust accumulation.

THE DOREX NO. 52 CELL... NEWEST ADDITION TO THE COMPLETE DOREX LINE.



You can depend on a specially designed Dorex unit to solve your particular air purification problem . . . whether your problem is 1 . . . 2 . . . or 3.

Dorex specialists, with more than a quarter century of experience and research in design and development of air recovery equipment, make the right recommendation . . . whatever the situation.

Dorex air purification units solve your problem. Dorex *Service Engineers* keep it solved . . . keep your system in continuous operation through a time-proven automatic reactivation-replacement program. Strategically located reactivation stations are maintained throughout the United States and Canada.

With each installation, Dorex assumes responsibility for economical and efficient operation . . . a responsibility lived up to for years for thousands of Dorex users.

For the best in air recovery products, insist on Dorex. Write for recommendations to solve your problem.

CONNOR... for Constant Comfort Conditions

Write for "Air Conservation Engineering"... the authoritative text on air purification.

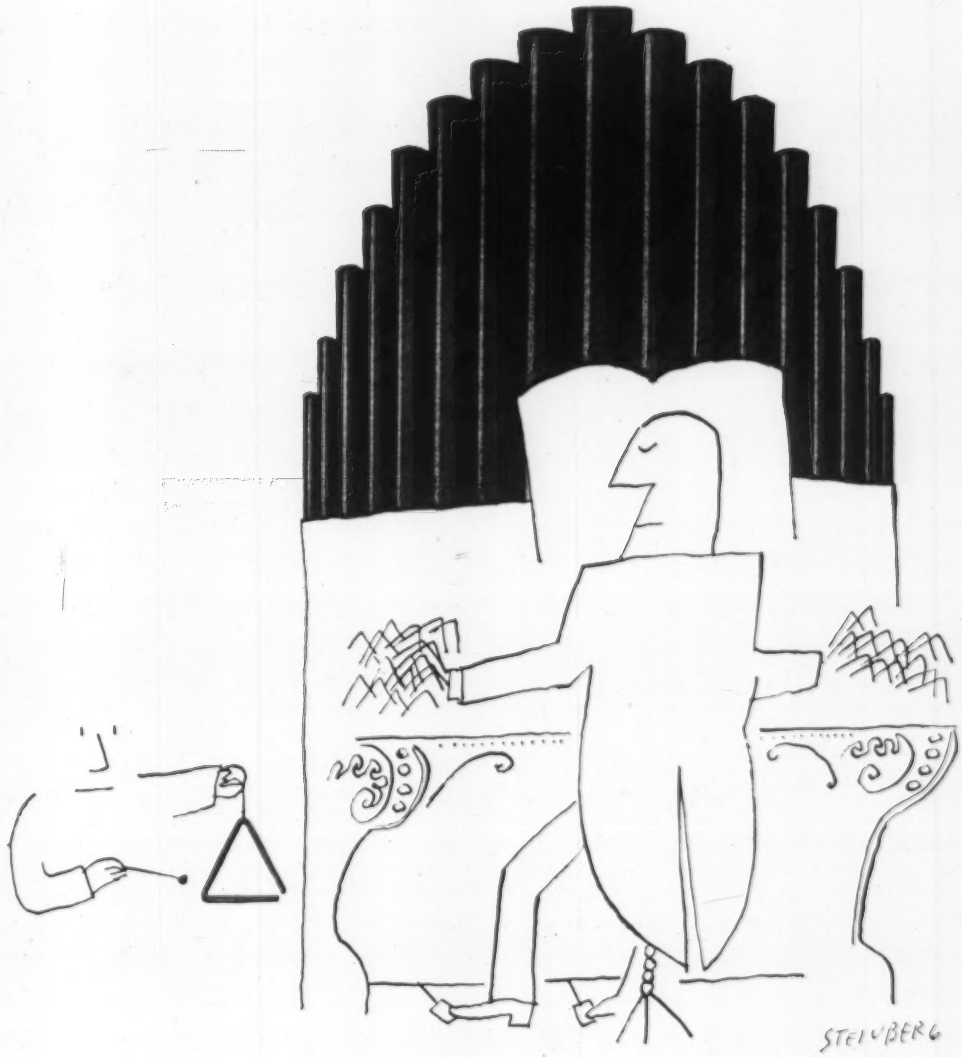
CONNOR

dorex®

air recovery

CONNOR ENGINEERING CORPORATION

82 SHELTER ROCK ROAD • DANBURY • CONNECTICUT



high fidelity

Lewin-Mathes' quality strikes a responsive accord.

Despite the large number of new customers for Lewin-Mathes Copper and Brass tube, pipe and rod in recent years, better than 90 per cent of our business comes from *repeat* customers. High fidelity of a rare order!

So long as we remain faithful to the highest standards of tolerance, temper and uniformity, we can expect our customers to remain loyal to Lewin-Mathes products. And as specialists—with a *completely integrated* plant designed specifically for the manufacture of tube, pipe and rod—it's in our own best interest to be *perfectionists.*

For the most fitting accompaniment to your plumbing, heating and air conditioning installations, specify...

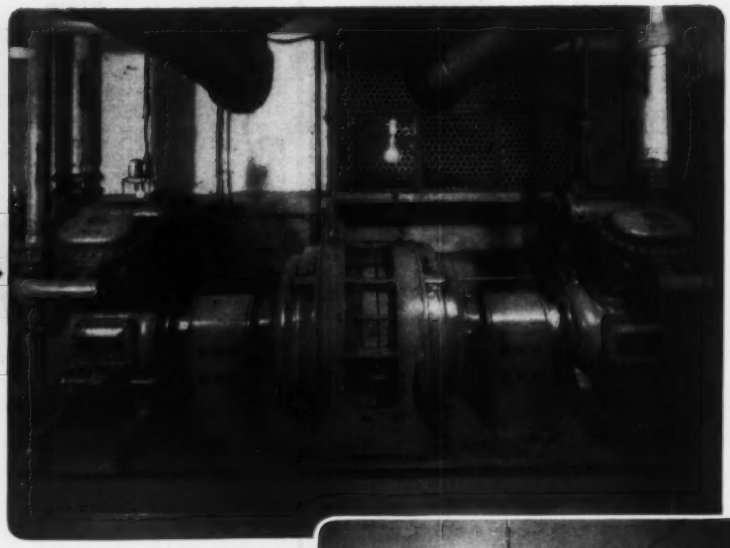
LEWIN MATHES

SAINT LOUIS, MISSOURI

COPPER AND BRASS TUBE, PIPE AND ROD

DIVISION OF CERRO DE PASCO CORP.

17 YEARS



FRICK

"ECLIPSE" COMPRESSORS AIR CONDITION TVA OFFICES

TENNESSEE VALLEY AUTHORITY
KNOXVILLE, TENNESSEE

Frick Company
Waynesboro
Pennsylvania

Gentlemen:

We have a Frick central air-conditioning system in our Old Post Office Building which was installed by your engineers in 1940. It consists of four compressors and two evaporative condensers.

As this equipment has been in continuous use throughout each year for seventeen years, we feel that it is time for a thorough check, and repairing or replacing of necessary parts.

To get a complete and competent check, and proper recommendations, we would like to have one of your staff engineers or field representatives examine our equipment and advise on necessary corrections; also to furnish any cost estimates.

If any of your factory personnel is planning on being in this area in the near future, we would appreciate their stopping here and making the inspection. In the event they do, would you advise us as to the date.

Very truly yours,

A. L. Boyd

A. L. Boyd
Eastern District Manager
Office Service Branch

TVA OFFICES AT KNOXVILLE, TENN.

Frick equipment is world renowned for being better-built, more economical, and giving a lifetime of dependable service.

What are your COOLING needs? If you want cool air, cold water, ice, extremely low temperatures, or refrigeration for quick freezing and processing—in any commercial or industrial sizes—call in a Frick representative at the planning stage for recommendations and estimates. They have the specialized knowledge and equipment to solve your cooling problems.

Our Booth at the International Heating & Air Conditioning Exposition is 309.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA., U. S. A.

BRUNER INDUSTRIAL WATER SOFTENERS

BRUNER WATER SOFTENERS & FILTERS

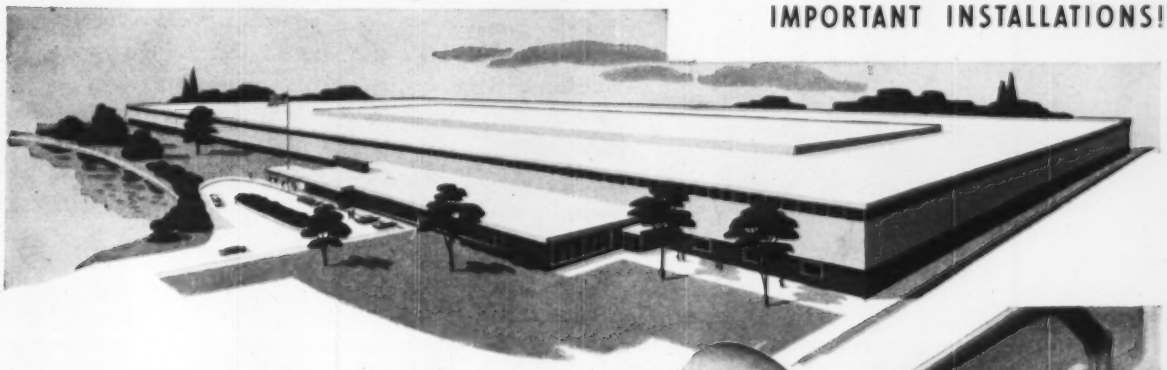
ARE FREQUENTLY

Specified

BY LEADING ENGINEERS FOR IMPORTANT INSTALLATIONS!

are meeting the needs of this important installation and in many other public and private buildings in all 48 states and seven foreign countries. They range from small laundries, schools, motels and resorts to huge hospitals, hotels, factories and atomic energy plants. Bruner is proud of its customer service — famous for product performance.

Bruner softeners, filters and other water conditioning components are available from stock in many types and sizes. Custom installations are fabricated to exact specifications.



Pictured above is exterior view of giant new Square D Co. plant in Glendale, Wis. This huge industrial facility required installation of three Bruner fully automatic water softeners with a total capacity of 1,440,000 grains and two fully automatic iron filters with regenerant tank (photo at right).

Consulting Engineer: L. R. Schmaus Co., Inc., Milwaukee, Wis.

Architect: Grassold-Johnson & Associates, Milwaukee, Wis.

Plumbing Contractor: Paul J. Grunau Co., Milwaukee, Wis.

Automatic Industrial Type Water Softener

Skidmore

. . . the PUMP that offers CUSTOM DESIGN — at a "standard price"

MAINTAINED SKIDMORE PUMPS EFFICIENCY

Built to match your exacting conditions . . . inexpensive to install . . . inexpensive to operate . . . . inexpensive to maintain. There's a Skidmore Heating Pump for that unusual condition—for that below floor level return—for that low return system or low and high pressure requirements. Advance design and engineering principles built into every Skidmore Pump will give you year-ahead dependability and trouble-free service on every job.

VACUUM PUMP

Capacities range from 5,000 to 100,000 sq. ft. E.D.R.

single unit

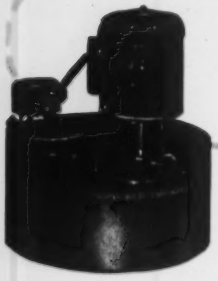
TYPE "UV" CONDENSATE

Capacities range from 2,000 to 40,000 sq. ft. E.D.R.

SKIDMORE PUMPS

(Below) TYPE "CVS"

Capacities range from 500 to 10,000 sq. ft. E.D.R.

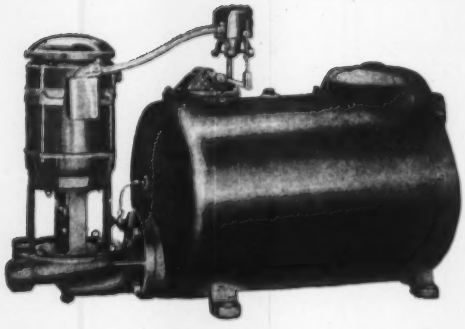


WRITE FOR BULLETINS

Specify a Skidmore Pump on that next job . . . there's one for every installation.

(Right) TYPE "VC"

Capacities ranging from 1,000 to 65,000 sq. ft. E.D.R.



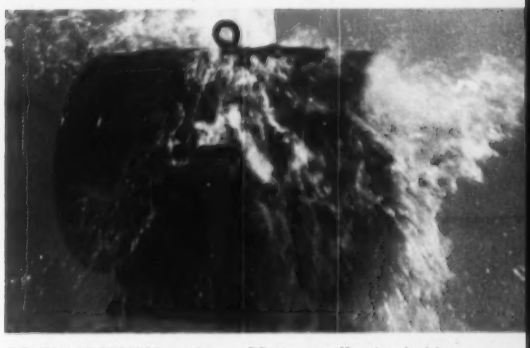
SKIDMORE CORPORATION

ST. JOSEPH, MICH.

YOU GET
DOUBLE PROTECTION
against corrosion...
against falling
or splashing liquids

Air intakes and outlets are positioned to provide complete dripproof protection.

TYPE DP
1 to 125 hp



DOUBLY PROTECTED—Wagner DP Motors offer the *double protection* of completely dripproof enclosures and rugged cast iron frames that can take rough handling and resist corrosion.

with WAGNER TYPE DP MOTORS designed to meet more application needs

Wagner Type DP Motors offer the *double protection* of rugged corrosion-resistant cast iron frames and dripproof enclosures so well designed that the DP Motor can handle many applications that formerly required splashproof motors.

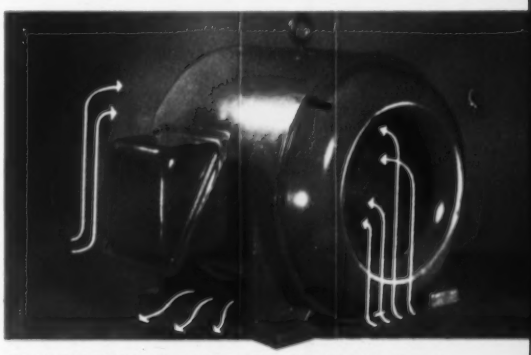
These Wagner Motors are built in the new NEMA ratings that pack more power in less space, are lighter in weight and are easier to maintain.

CAN BE RELUBRICATED—Factory lubrication will last for many years in normal service—but openings are provided to permit the relubrication that adds years to motor life under severe conditions.

SLEEVE BEARING MODELS AVAILABLE

The entire line of ratings through 125 hp is available with ball bearing construction as illustrated, or with steel-backed, babbitt lined sleeve bearings that have high load carrying capacity and provide quieter operation.

Let a Wagner Sales Engineer show you how these motors can be applied to your needs. Call the nearest branch office or write for Wagner Bulletin MU-223.



COOL RUNNING—Specially designed baffles direct cooling air through the motor to reduce stator temperature—thus increasing motor life. Blowers, cast as part of the rotor, move large volumes of air without noise or vibration.

1 to 125 HP—1750 RPM—40°C
NEMA FRAMES 182 through 445U

Wagner Electric Corporation
6400 Plymouth Ave., St. Louis 14, Missouri.

WM58-9

YOU GET
EXTRA PROTECTION
against corrosive... abrasive or explosive elements

TYPE JP
Explosion proof
1 to 100 hp

TYPE EP
Standard TEFC
1 to 100 hp

with Wagner totally enclosed motors... protected for longer motor life

If you need motors that will keep production rates up . . . that will give the continuity of service that is so important to automation . . . that will operate with complete dependability under the most severe conditions —Wagner totally-enclosed motors are your soundest choice.

Type EP Motors offer protection against corrosion, dust, abrasives, fumes, steel chips or filings. Type JP is explosion proof as well — designed and approved for use in explosive atmospheres.

NEW NEMA FRAMES—These motors are built in the new NEMA Frame sizes from 182 through 445U, with ribs that add mechanical strength and increase the surface cooling area. Effective cooling system adds to motor life.

Let your Wagner Sales Engineer show you how these protected motors can bring you savings on initial motor costs, maintenance costs and continuity of operation.

1 TO 100 HORSEPOWER—4 POLE, 60 CYCLE—NEMA FRAMES 182 THROUGH 445U

Wagner Electric Corporation

6400 Plymouth Ave., St. Louis 14, Missouri. Branches and Distributors in All Principal Cities

HEAVY DUTY BALL BEARINGS

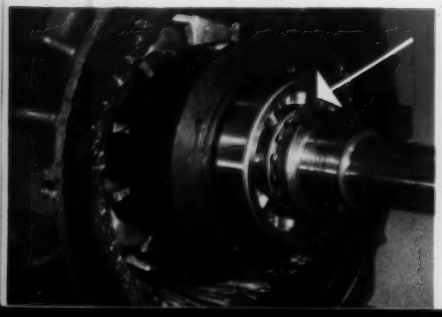
The ball bearings used in these motors are of the highest quality, with more than ample capacity to provide long troublefree service under heavy loads.

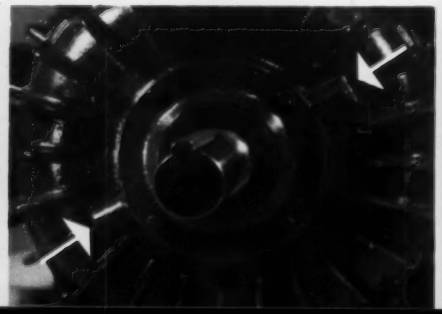
BEARINGS CAN BE RELUBRICATED

Factory lubrication will last for many years under normal service, but openings are provided to permit relubrication that adds years to motor life under severe conditions.

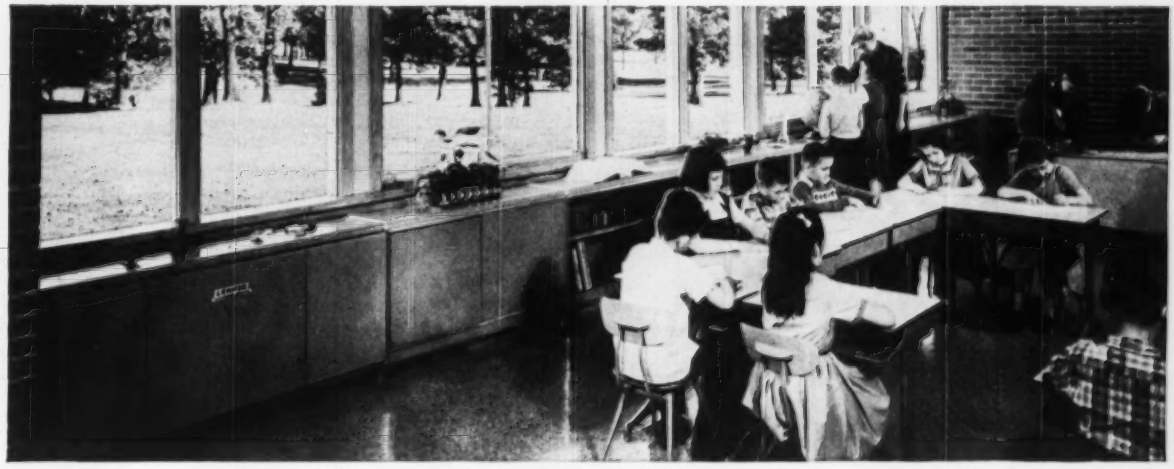
SEALS KEEP BEARINGS CLEAN

Both ends of these motors have running shaft seals to keep the bearings clean. Bearing housings are effectively sealed to prevent escape of grease.





Fresh air heating and ventilating for classrooms...for as little as $1.03 per square foot!



New Lennox Comfort Curtain system automatically draws in fresh air from outside...warms, cleans, circulates air... provides tons of needed cooling without the cost of refrigeration!

Across the country, the Comfort Curtain system is drastically reducing the cost of school heating and ventilating. Costs per square foot of $1.03 in Indiana, $1.15 in Montana, $1.12 in South Dakota are typical. One job went in for *just 65c per square foot*, in Potosi, Missouri!

These exceptional savings are the result of a new approach to classroom heating and ventilating, provided by the Lennox Comfort Curtain system. This new system applies to schoolrooms the sound, tested principles of warm air heating, thus eliminating the cost of pipes, boilers, towering chimneys and inflexible heating plants.

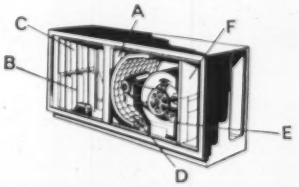
And most important, the Lennox Comfort Curtain system actually does a *far better* job than costlier systems used previously. It provides a full, even flow of air throughout its entire length along the exposed classroom wall. It is amazingly quiet. And it holds room temperatures to a variance of six-tenths of one degree, circulates air continuously for perfect distribution, introduces a continuous supply of fresh air during the daytime heating cycle, and provides *tons* of needed cooling without the cost of refrigeration.

Extensive surveys show that on almost every day when the temperature is above freezing, the classroom no longer requires heat, shortly after pupils assemble. True, at 33° the average classroom needs about 20,000 Btuh. But 30 pupils will generate about 12,000 Btuh, lighting will add another 8,000 to 10,000 Btuh, and the sun load can account for as much as 15,000 Btuh. Since the amount of heat being generated exceeds the classroom heating requirement, it becomes necessary to *cool* the classroom to maintain a healthful, comfortable temperature. The Lennox Comfort Curtain system does this automatically by introducing cool, fresh outside air.

There is today no possible way to achieve all these advantages at so little cost—except with the Lennox Comfort Curtain. The system is completely flexible, uses child-proof wall- or bookshelf-ducts, installs readily in any size or design of school, comes completely equipped with a "laboratory matched" control system. Send coupon below for free booklet.

LENNOX

© 1958 Lennox Industries Inc., founded 1895; Des Moines and Marshalltown, Ia.; Syracuse, N. Y.; Columbus, O.; Decatur, Ga.; Ft. Worth; Los Angeles; Salt Lake City. In Canada: Toronto, Montreal, Calgary, Vancouver, Winnipeg.



The Lennox Air Processing Unit introduces fresh air in adjustable volumes (A); transmits warm air (B) from adjacent or remote heating unit; continuously recirculates indoor air (C); filters air clean (D). Lennox' exclusive floating blower (E) and acoustical lining (F) assure a degree of quietness never before achieved.

Lennox Industries Inc., Dept. HP-8
1701 E. Euclid Ave., Des Moines 5, Iowa

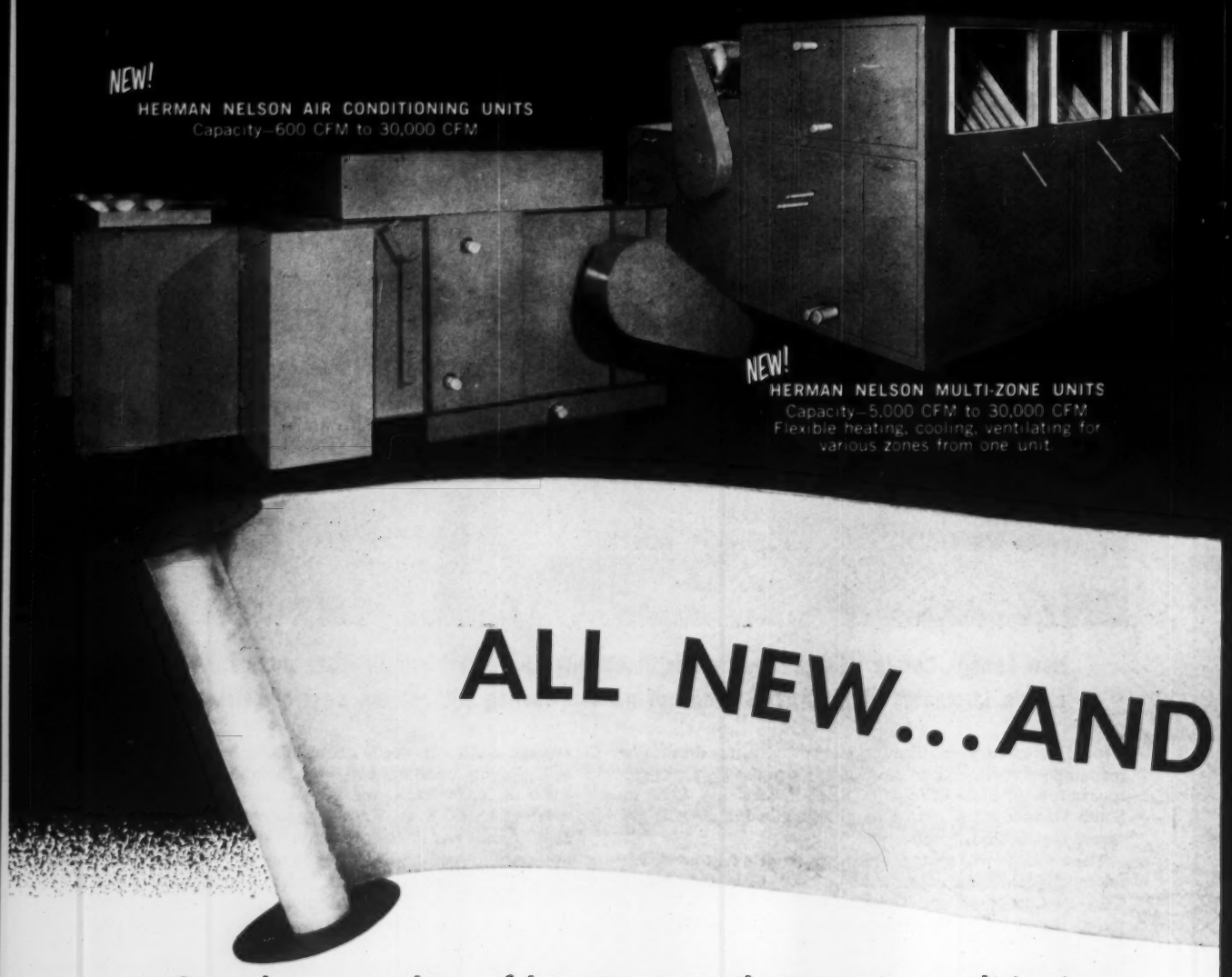
Gentlemen: Please send me your free booklet on the Comfort Curtain system of classroom heating and ventilating.

NAME_____

ADDRESS_____

_____

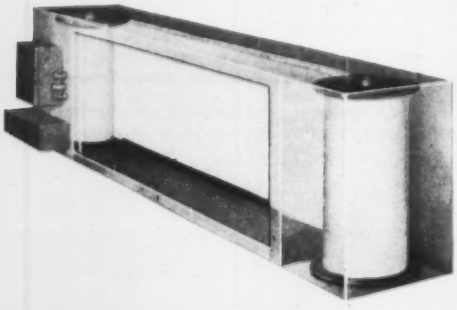
CITY_____ ZONE____ STATE_____


NEW!
HERMAN NELSON AIR CONDITIONING UNITS
Capacity—600 CFM to 30,000 CFM
NEW!
HERMAN NELSON MULTI-ZONE UNITS
Capacity—5,000 CFM to 30,000 CFM
Flexible heating, cooling, ventilating for various zones from one unit.

ALL NEW...AND

Complete new line of heating, ventilating, air conditioning and multi-zone units change their own filters, automatically

These new AAF-Herman Nelson lines incorporate some of the most advanced features found in any heating, ventilating and air conditioning equipment. Outstanding among these features is the exclusive Roll-O-Vent that automatically changes its own filters. It gives you maximum uniform filtering efficiency the year 'round, with little or no maintenance. Air filtering is always constant, because clean media is fed through automatically and at just the right time. One roll of media does the work of about a year's supply of disposable filters, at about one-half the cost. There's nothing to touch—not even a button. Think of the maintenance saving! Plan your new jobs with these AAF-Herman Nelson units . . . *all new . . . and Roll-O-Vent, too!*



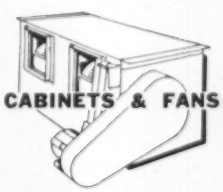
These four great new lines are ready to give you superior performance for any air handling need, large or small. There are 12 basic sizes of each unit—48 in all—handling from 600 CFM up to 65,000 CFM. Sectionalized construction permits installations "tailor made" to your specific requirements.

Better Air is our Business

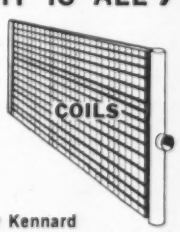
ROLL OVENT TOO

These air handling units are engineered throughout by AAF-Herman Nelson . . . one reliable source to solve all your heating, ventilating and air conditioning problems. Write today for further information.

EVERY AAF UNIT IS ALL American . . . ALL THE WAY!



+



+

= ONE MANUFACTURER
ONE RESPONSIBILITY
ONE HIGH STANDARD OF QUALITY

by Herman Nelson a Division of AAF
Over 50 years experience in ventilation field.

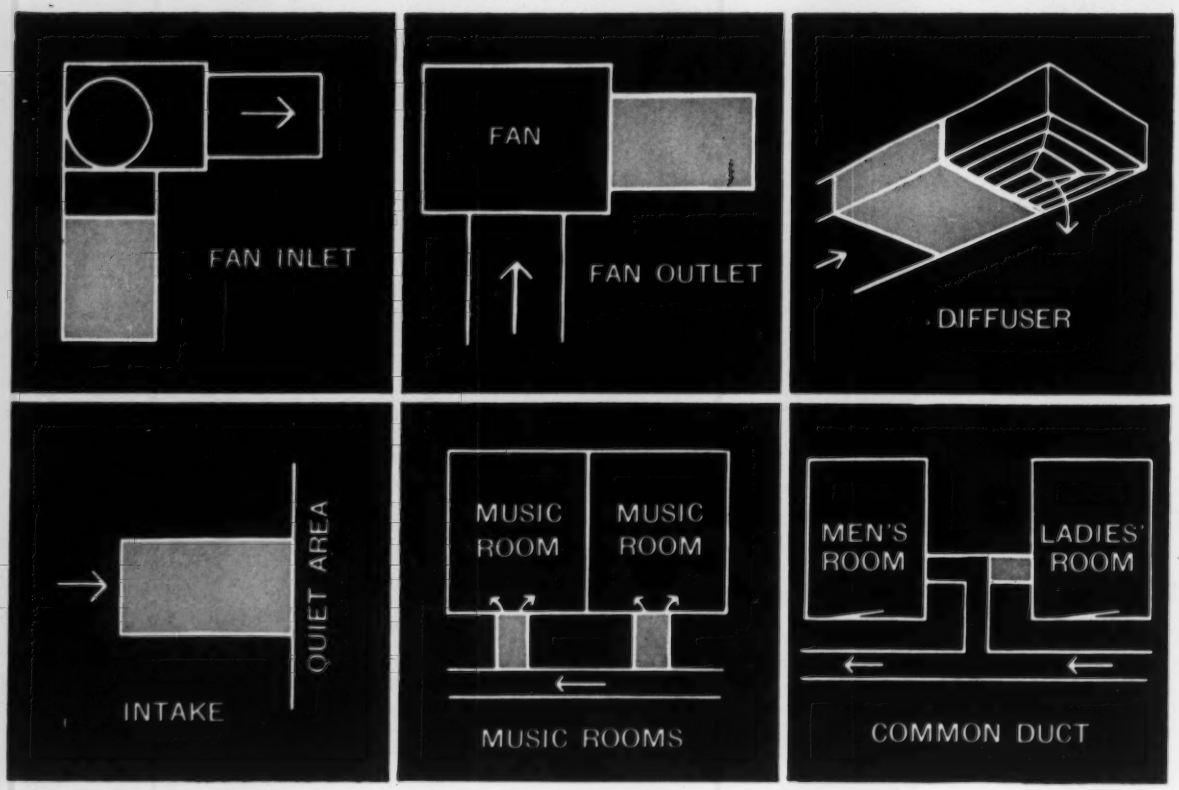
by Kennard a Division of AAF
Standard of excellence in coils since 1934.

by Air Filter Division of AAF
World's largest manufacturer of air filters.

American Air Filter

COMPANY, INC. • 373 CENTRAL AVE. • LOUISVILLE, KY.

AAF
herman nelson

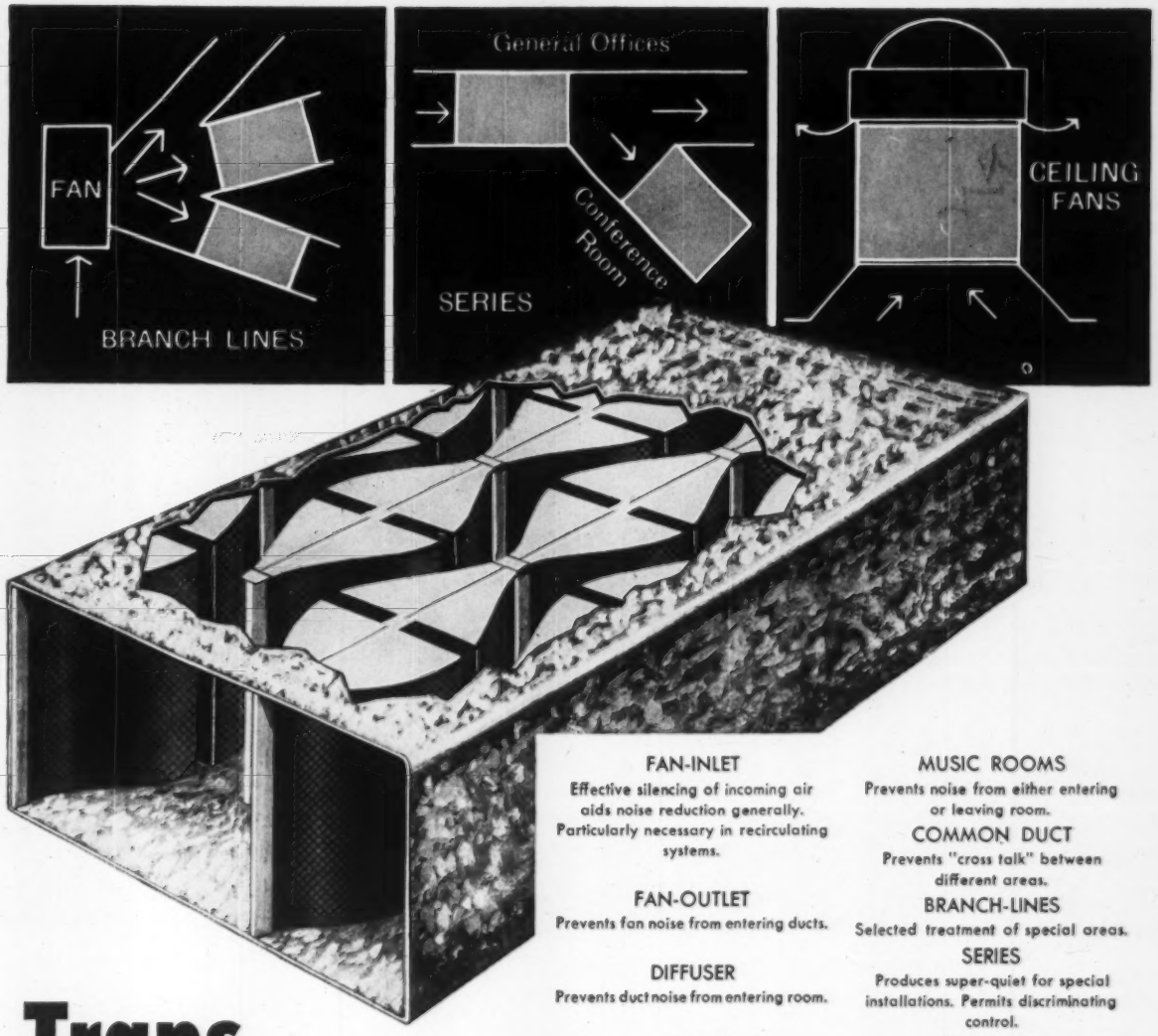


Every Building Needs Aircoustat® Sound

AIRCOUSTAT silences noises of all frequencies

Eliminate disturbance, distraction and irritation caused by noises escaping from one area to another through ductwork.

Install AIRCOUSTAT Sound Traps. AIRCOUSTAT eliminates guesswork, wasted space and unnecessary expense of duct lining. You can guarantee your client trouble-free performance. You can estimate with complete confidence the performance of particular applications. If AIRCOUSTAT fits geometrically, it fits acoustically.



Traps

FAN-INLET
Effective silencing of incoming air aids noise reduction generally. Particularly necessary in recirculating systems.

FAN-OUTLET
Prevents fan noise from entering ducts.

DIFFUSER
Prevents duct noise from entering room.

INTAKE
Prevents outside noise from entering quiet area.

MUSIC ROOMS
Prevents noise from either entering or leaving room.

COMMON DUCT
Prevents "cross talk" between different areas.

BRANCH-LINES
Selected treatment of special areas.

SERIES
Produces super-quiet for special installations. Permits discriminating control.

CEILING FANS
Prevents fan and exhaust noise from disturbing particular areas.

traveling from one area to another through ductwork

AIRCOUSTAT saves you space. Its greater effectiveness permits smaller-sized ducting. It eliminates bulky mufflers.

For more details, write to KOPPERS COMPANY, INC. Industrial Sound Control Dept., 6209 Scott Street, Baltimore 3, Md.

KOPPERS

INDUSTRIAL SOUND CONTROL

Engineered Products Sold with *Service*

For more than just a motor

Solve your motor problems with

You can make your job easier with Century Electric's complete line of fractional-horsepower motors. Here's how:

Easy ordering—You save time because you get answers to all motor problems from one source. This means you don't have to shop around for the motor you need. You name it—capacitor, jet pump, unit heater, oil burner, brake, gear—any one you want, and in all types of enclosures too.

Fast shipments—From Century Electric's complete stock you can get a motor for any standard application. In addition, motors are packed in sturdy boxes so if you reship you know they'll arrive in good condition.

Century's complete fractional line

Application know-how—You want to be sure you have the *right* motor for the job. And if you need expert help, you can get it from your nearest Century Electric sales engineer. He knows motors inside and out because he sells, applies and thinks motors day after day.

This is why you get *more* than just a motor from Century Electric. You get a quality product, fast answers and engineering application know-how on motors up to 400 hp—all from one source.

CENTURY ELECTRIC COMPANY

St. Louis 3, Missouri *Offices and Stock Points in Principal Cities*

Century

58-19

WAYS TO ARRIVE AT PROPER VENTILATION

No two ventilating systems are likely to be exactly the same. Conditions vary; so should the fans. The six examples illustrated here cover the situations most often encountered in industrial plants.

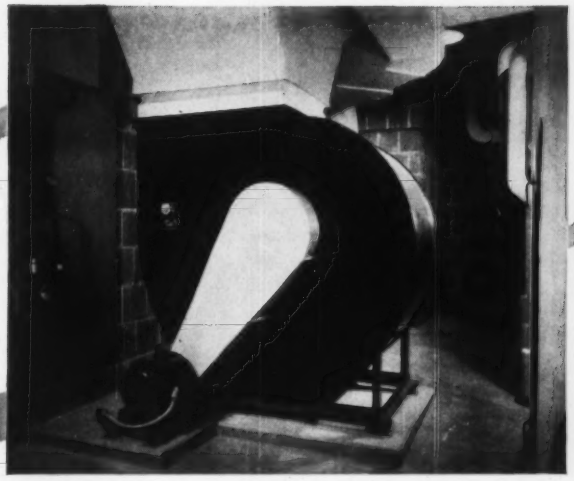
In many instances, the right combination of ventilating installations can go a long way toward modernizing existing buildings.

Better working conditions usually result in improved morale and greater worker efficiency.

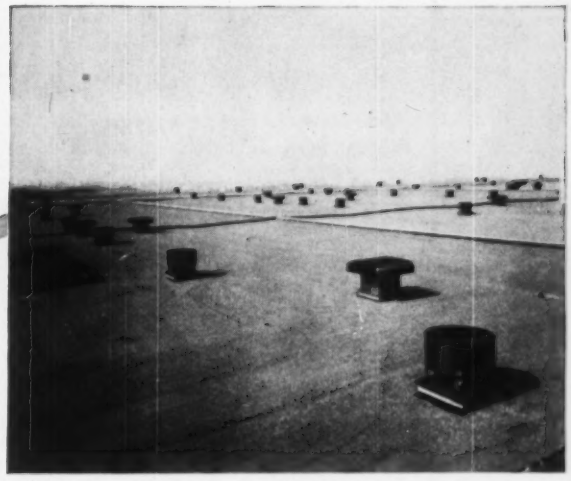
While complete air conditioning is desirable, and in many cases absolutely necessary from a manufacturing standpoint, adequate ventilation many times will do a satisfactory job.

And for the best in ventilating fans, contact your local "Buffalo" Engineering Representative or write:

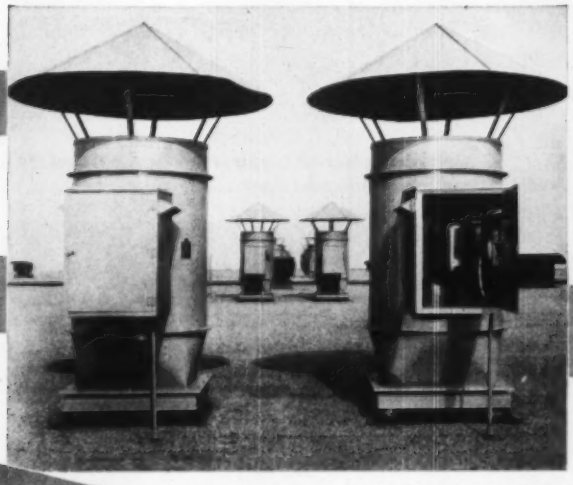
BUFFALO FORGE COMPANY, Buffalo, New York



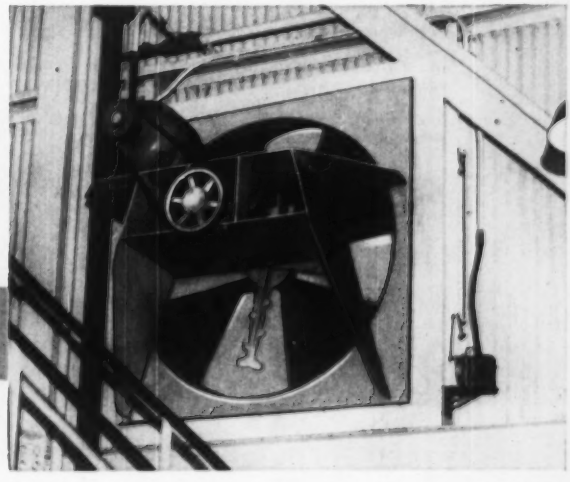
CENTRAL SYSTEM ventilation, which very often incorporates air conditioning and heating, requires the high efficiencies and capacities of large centrifugal fans. Capacities range to 500,000 cfm.



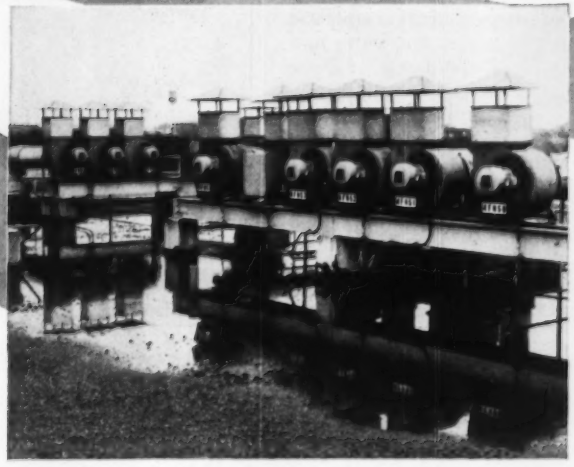
THROUGH THE ROOF is the best way to ventilate large areas where duct work is undesirable. Allows flexibility of plant layout. New models in capacities up to 250,000 cfm.



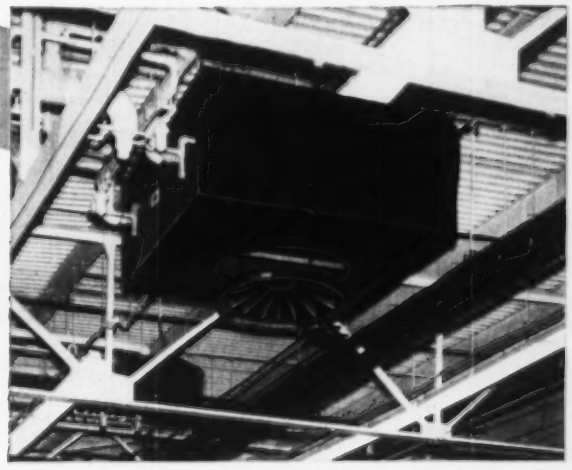
CONFINED AREA exhaust such as spray booths, hood installations, function best with efficient, powerful axial flow fans. Units easily installed in ducts.



LOWEST COST ventilation for open areas is made possible by large propeller fans. New designs offer higher efficiencies, larger capacities (250,000 cfm).

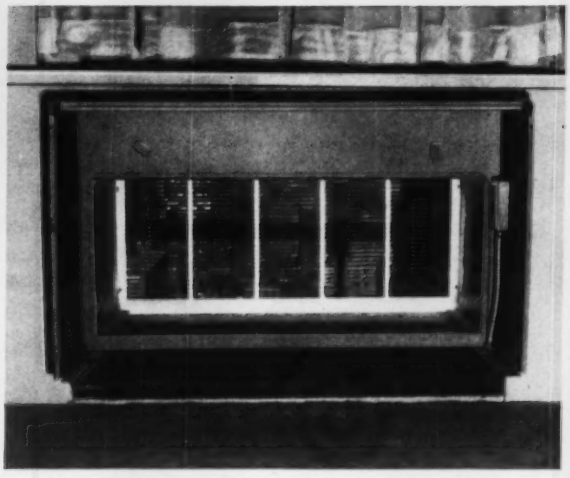


CORROSIVE FUMES can be exhausted with cast iron fans as shown. Also available are fiber glass fans, rubber and other specially coated units.



PUTTING BACK AIR exhausted is job for low cost, high capacity make-up air units. Fans, heating coils, filters, diffusers included in "package" units.

In new construction, the wall sleeve goes in as the building goes up—becomes a permanent part of the structure. Chassis will be in the wall behind a sound-deadening and thermal bulkhead.

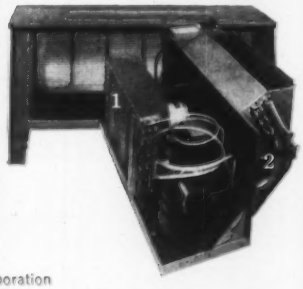


In modernization, existing radiation is removed. Wall sleeve is sealed in a hole cut through the wall. Special flush-fitting louver provides positive weather seal and neat exterior appearance.

For new construction or modernization...

Select this versatile year 'round air

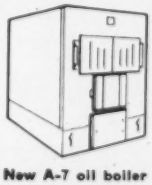
Cooling circuit in each unit eliminates central cooling plant and ducts (see 1). Three types of integral heating coils are available (see 2)—steam, hot water and electric. Steam and hot water coils are easily connected to central-system piping.



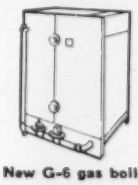
American-Standard and "Standard"® are trademarks of American Radiator & Standard Sanitary Corporation

For complete satisfaction, do the job with an American-Standard boiler

Oakmont oil boiler

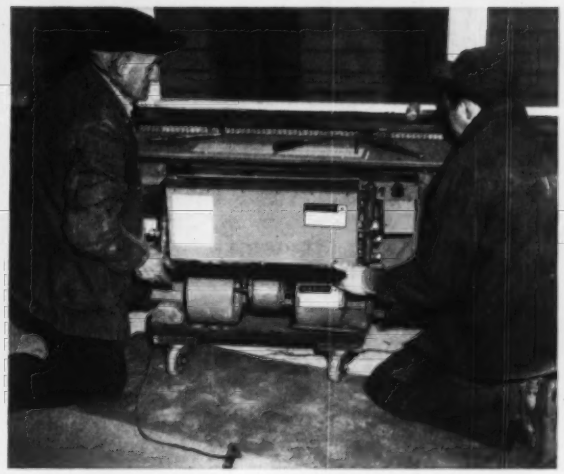


New A-7 oil boiler

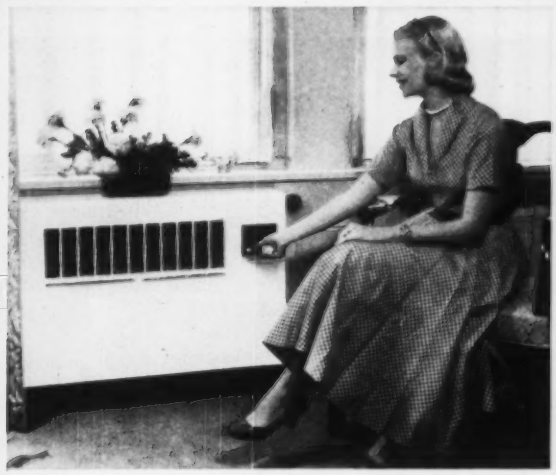


New G-6 gas boiler

G-4 gas boiler



Self-contained heating-cooling chassis slides into wall sleeve as a single unit for easy installation; slides out for easy maintenance. Entire unit carries the UL Re-examination Service Marker.



Individual-room temperature control allows occupant of one room to dial heating, occupant of another to dial cooling during "in-between" seasons. Three cabinet styles meet all installation requirements.

conditioning system with individual room units

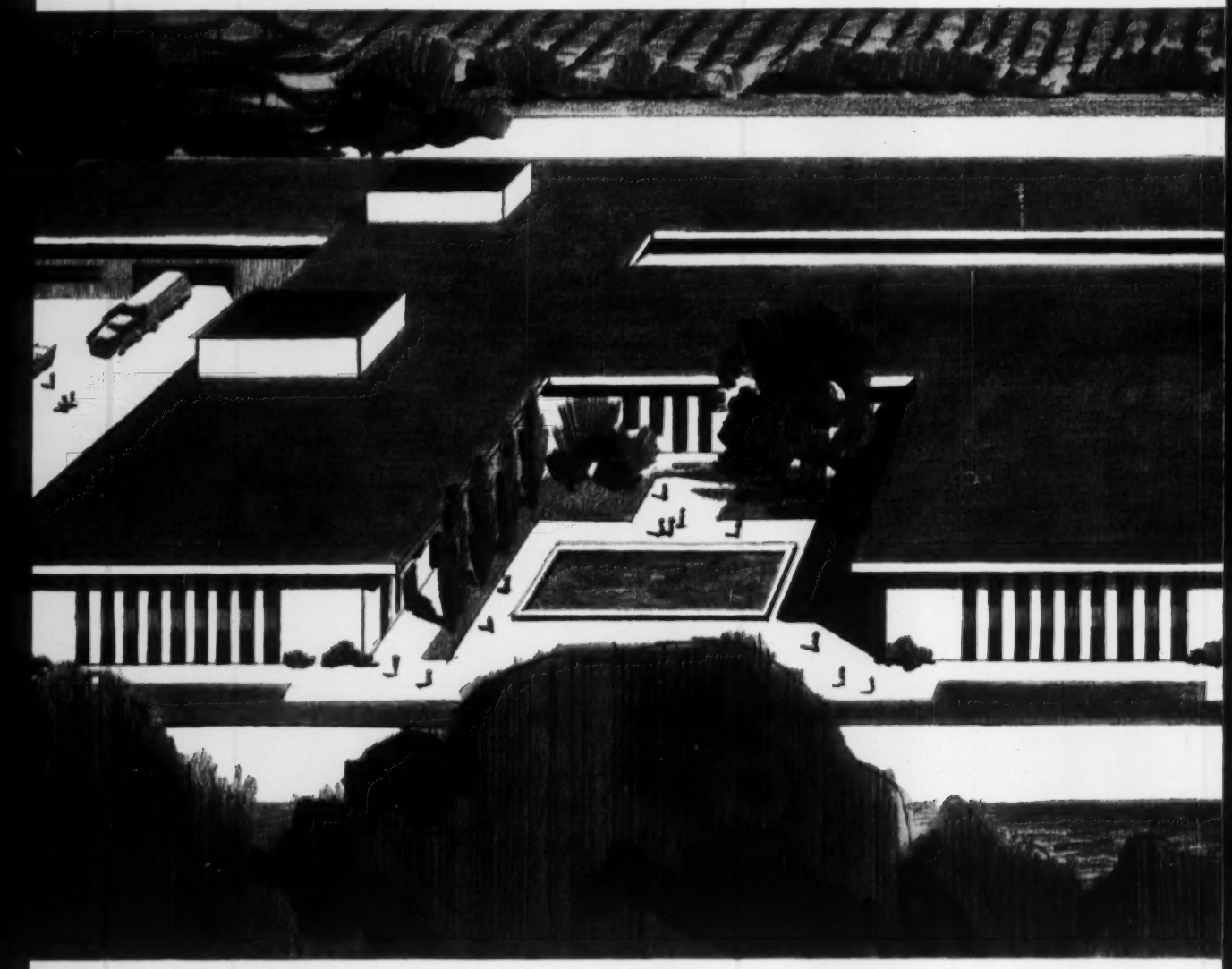
The American-Standard Type 40 Remotaire System is ideal for both new construction and modernization. An outstanding feature of this year 'round system is the individually controlled room unit. Each unit has its own refrigeration circuit. No central cooling plant, tower or duct is needed. For heating, a boiler supplies hot water or steam to room units. In modernizing, units are connected to existing heating piping. Type 40 Remotaire solves many budget problems because it can be installed in a wing, a floor, a room at a time.

For details of this versatile system call your American-Standard sales office or write AMERICAN-STANDARD, PLUMBING AND HEATING DIVISION, 40 W. 40 St., New York 18, N. Y. In Canada, AMERICAN-STANDARD PRODUCTS, LTD., Box 39, Station D, Toronto.

AMERICAN-Standard

PLUMBING AND HEATING DIVISION

...NOW WE'RE



Specify Arkla-Servel Gas Air Conditioning and you specify years of trouble-free comfort

With the new Arkla-Servel Gas Absorptive Cooler, your clients will get extra—even exclusive—advantages that they'll get *only* with a gas cooling system.

Only gas gives these important advantages:

. . . High efficiency at *all* times—even during the light loads.

. . . Constant temperature control.

. . . Modular adjustment of capacity (instant automatic adjustment to match actual cooling requirements).

. . . Dependability of fuel service at all times.

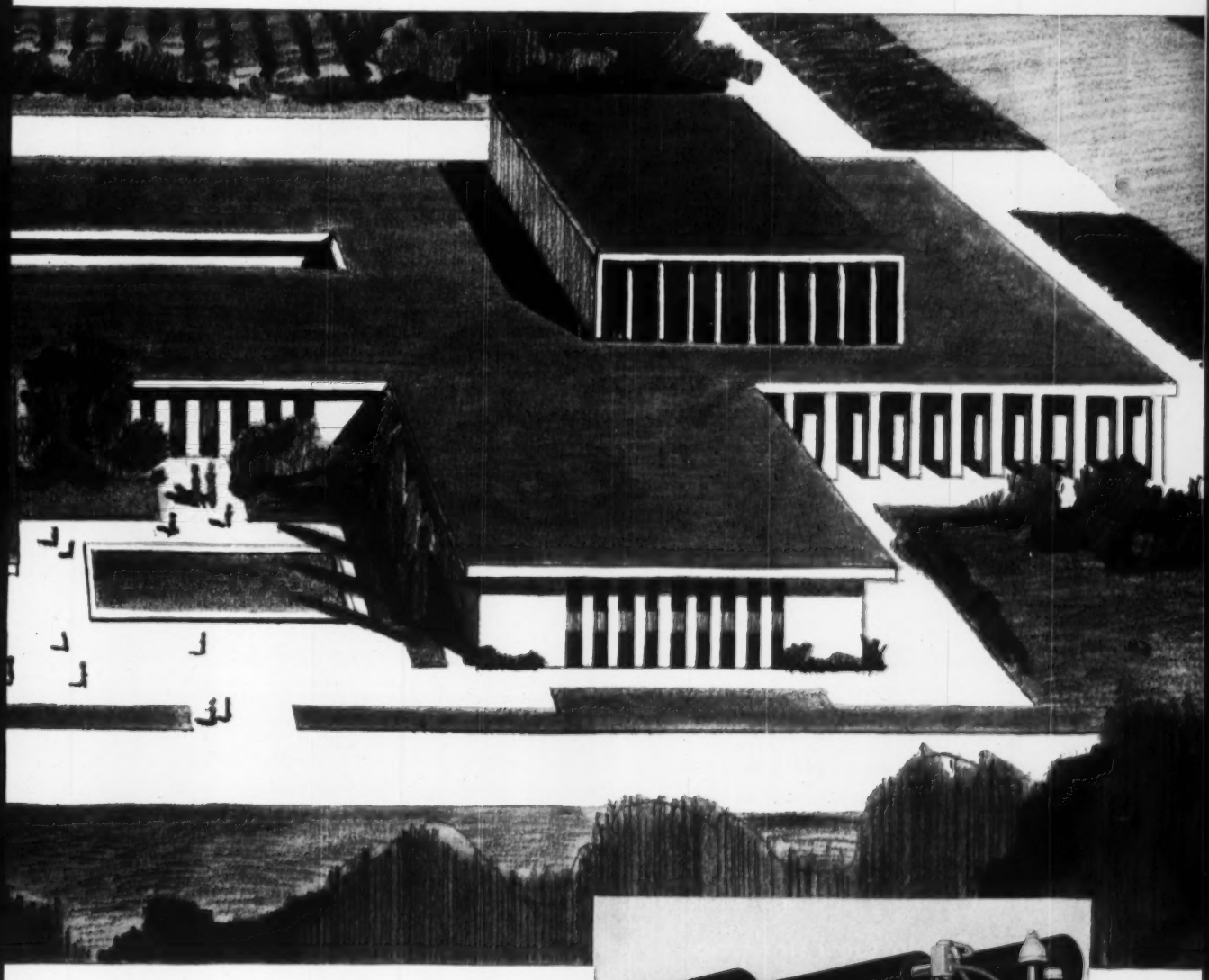
The 25-Ton Arkla-Servel Cooler

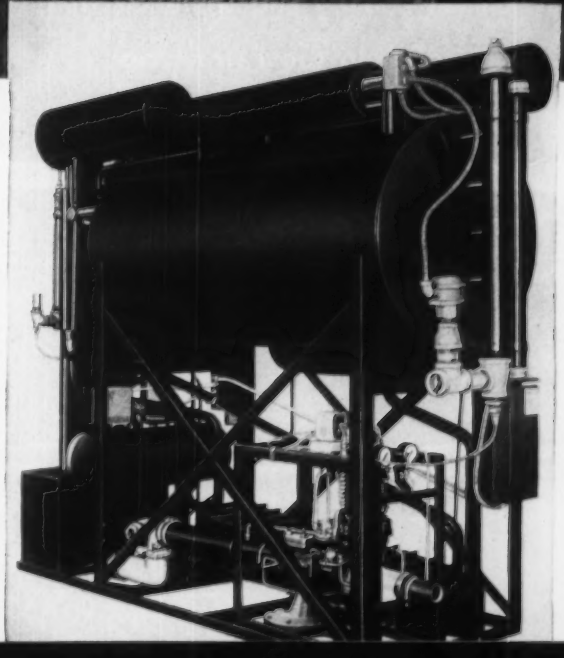
. . . A compact unit, easy to install and light enough for rooftop installation.

. . . Costs are low for installation, operation and maintenance. No specially trained operating or maintenance personnel are required.

. . . Can be installed singly or in banks to fit any size installation.

COOLING WITH GAS





Gas absorptive cooling can put your commercial and industrial clients' heating plant on a year around paying basis. It utilizes low pressure steam to cool water, has no moving parts to wear out, and provides quiet, economical operation. What's more, it's *vibration-free*.

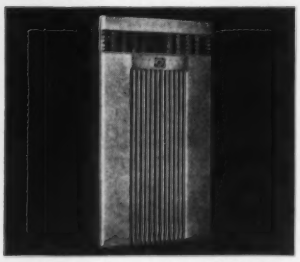
Take advantage of the consulting free services provided for you by your gas company. They have trained specialists who have been working with contractors and builders for years. They belong to your associations or affiliations and are familiar with your problems. Check the facts about gas and you'll see—modern gas air conditioning out-performs all other fuels. *American Gas Association.*

ALL NEW AMERICAN

FAN-COIL-TYPE

Tonrac® Centrifugal Refrigeration Machines maintain constant chilled-water temperature regardless of load. Advanced design, quiet operation.

Type AB Multi-Zone Unit. Single arrangement provides either vertical or horizontal blow. Designed for either low-pressure or high-pressure systems.



American Blower Packaged Air Conditioners. Sizes from 3 to 20 tons. Air- or water-cooled models for use with or without ductwork.

BLOWER DIAFLO®

UNIT AIR CONDITIONERS

Diaflo units are designed, engineered, and manufactured to meet the professional requirements of each member of the building team

Architect

"They provide the design flexibility and pleasing appearance an architect likes in a unit air conditioner. They adapt readily to both new and existing buildings, with a choice of lengths to fit modularly spaced partitions. Diaflo units are completely suitable for new curtain-wall-type buildings or for other types of construction."

Consulting Engineer

"They're versatile mechanically, too, with rugged, heavy-gauge construction. Two basic units permit either vertical or horizontal installation. Front or top discharge is available on vertical unit. Universal coil permits summer cooling with chilled water, and winter heating with hot water. Coil is suitable for manual, electrical, or pneumatic control."

Mechanical Contractor

"Diaflo units provide a really 'clean' installation. Base unit is easily mounted with free access on both ends for all connections. Installer can work freely without being cramped. This saves time and money. Then just prior to start-up, clean, undamaged enclosure can be hung in place."

Owner

"Diaflo units certainly fit the requirements of modern building air conditioning. They harmonize well with practically any interior decor—are quiet, draft-free, and permit room occupants to select their own temperature. Maintenance is economical, too. Filter removal is easy, and there is ready access to all controls."

You can pinpoint responsibility for equipment performance, delivery dates, user satisfaction on any air-conditioning system you plan by using American Blower equipment . . . the complete line that's designed, engineered, and manufactured to work together.

And 73 branch offices offer local product help or nation-wide sales-service coordination. American-Standard,* American Blower Division, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

* American-Standard and Standard are trademarks of American Radiator & Standard Sanitary Corporation.

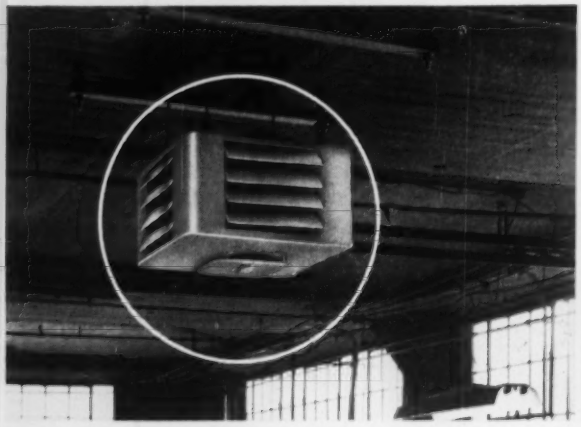
AMERICAN-Standard

AMERICAN BLOWER DIVISION

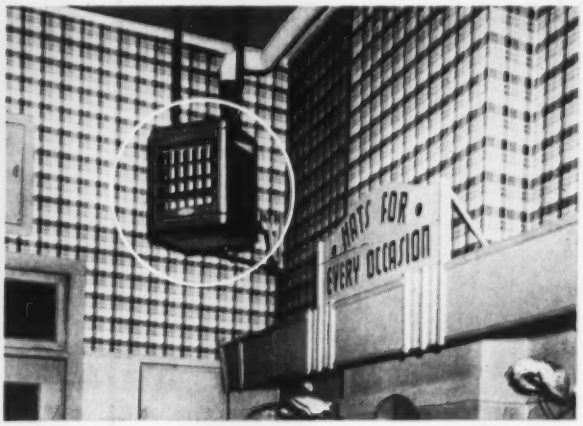
Which is the best way to heat a building?

It depends on the building. The size, the purpose, and the source of heat available can make a big difference. That's why Carrier offers such a wide selection of types and sizes of heaters, and that's why your Carrier agent is the man to work with. Since the Carrier Unit Heater line includes almost every type of commercial or industrial heating equipment, his only interest is to supply you with the type that serves you best in every kind of installation. You'll find him listed in your Classified Telephone Directory under "Heaters—Unit." Carrier Corporation, Syracuse, New York.

FOR SMALL BUILDINGS...

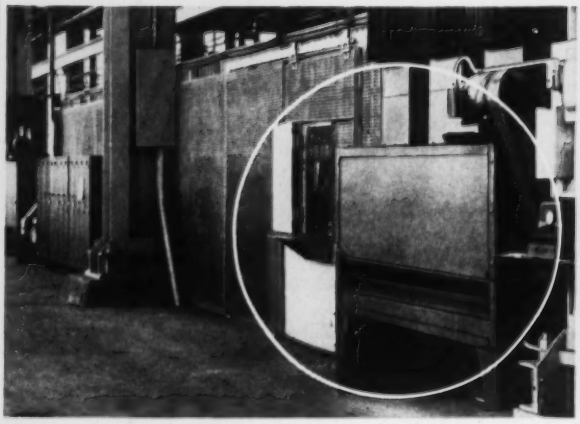


With steam or hot water, choose Carrier 4-Way Unit Heaters. Truly versatile, just one of these exclusive "Clover Leaf" models can do the job of two or more ordinary heaters. Carrier also offers horizontal, vertical and cabinet style unit heaters.

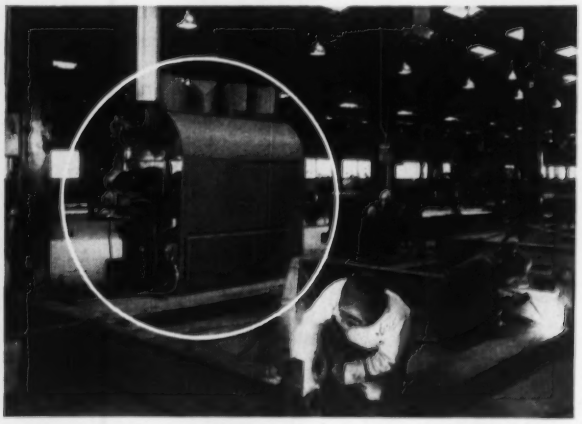


With gas, choose Carrier Gas-fired Unit Heaters or Duct Furnaces... featuring heat exchangers made of aluminized steel for long, dependable service. New large size duct furnaces available for heating in conjunction with air conditioning.

FOR LARGE BUILDINGS...



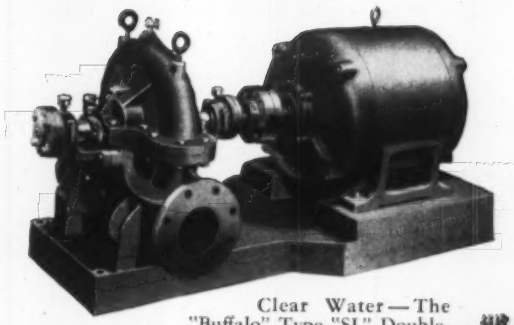
With a central source of heat, choose Carrier Heat Diffusers or Heating and Ventilating Units. Heavy duty blowers, coils, housings and outlets may be individually selected to make up units that perfectly match your heating requirements.



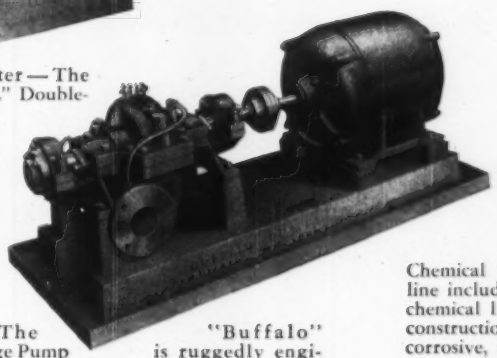
Where there is no boiler, Carrier Heat Diffusers, Direct Fired, offer the most economical method of heating large areas. Completely self-contained, and factory assembled, they need only fuel and power connections to be put in operation.

Carrier

industrial heating
air conditioning
refrigeration

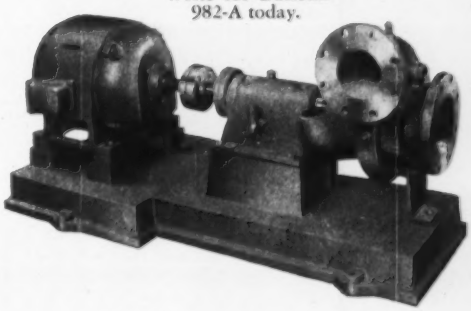


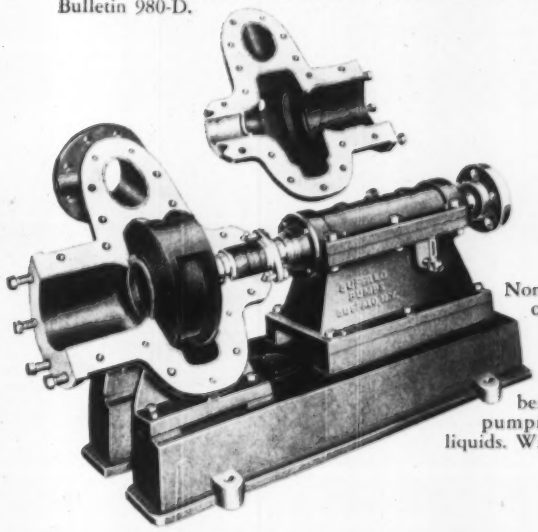
Clear Water — The "Buffalo" Type "SL" Double-Suction Pump is recognized for its highly efficient clear water service throughout industry. Capacities from 10 to 14,000 gpm. Write for Bulletin 955-R.



High Pressure — The "Buffalo" Type "RR" Multi-Stage Pump is ruggedly engineered to deliver peak efficiency on boiler feed and other clear water applications against heads as high as 1500 feet. Capacities range up to 900 gpm. For full details write for Bulletin 980-D.

Chemical Liquids — The complete "Buffalo" line includes ten specially designed pumps for chemical liquids. Available in several types of construction for handling a wide variety of corrosive, abrasive or high-consistency liquids. Write for Bulletin 982-A today.





Non-Clogging — "Buffalo" Diagonally Split-Shell Pumps are designed for moving high-consistency liquids, with down-time reduced to an absolute minimum. A number of models are available for pumping abrasive and corrosive liquids. Write for Bulletin 953-K.

WHATEVER YOUR LIQUID-MOVING PROBLEM, THERE'S PROBABLY A "BUFFALO" PUMP TO SOLVE IT!

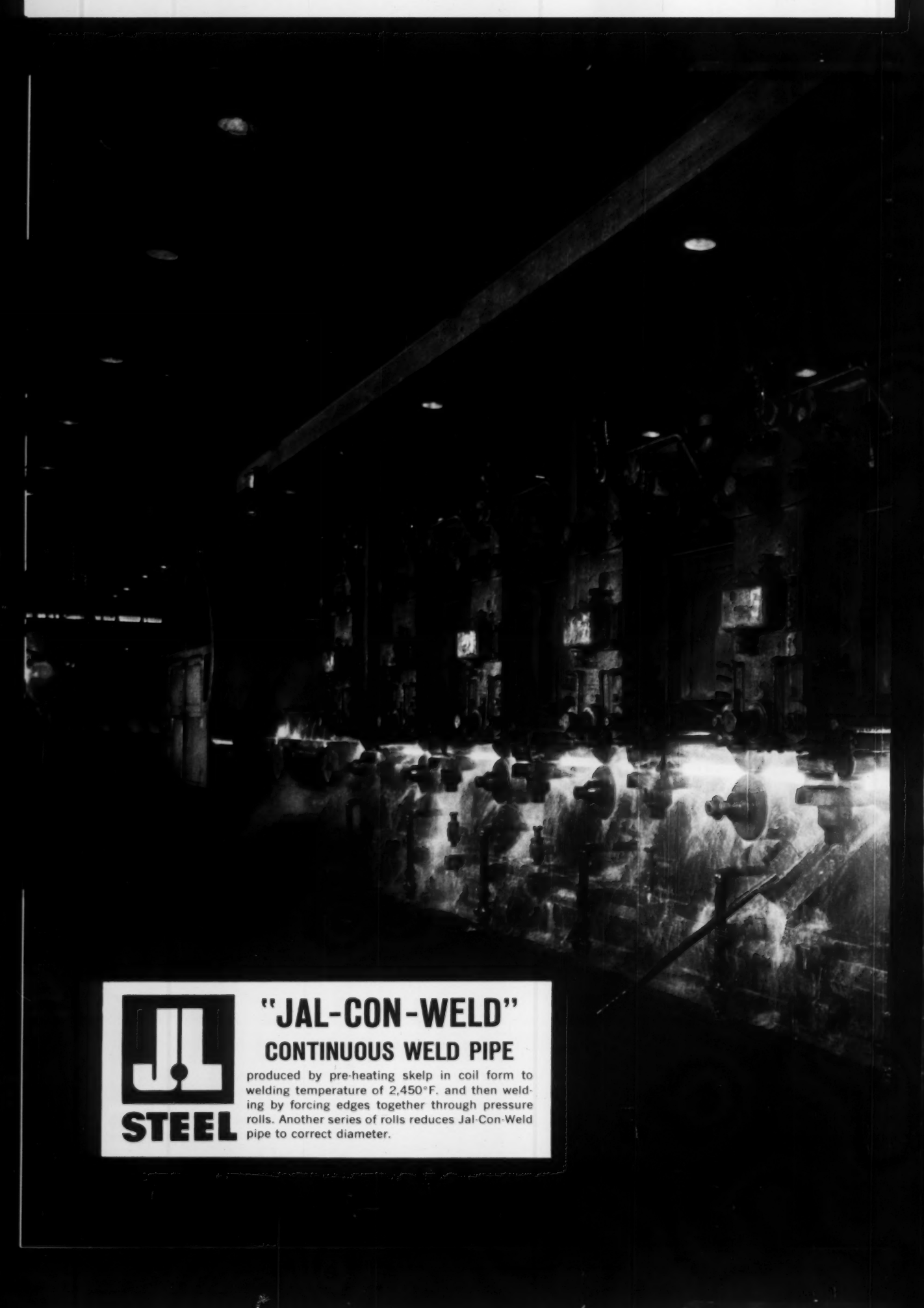
And the fact that "Buffalo" builds a *complete line* of pumps — a type, size and capacity to fit almost every liquid-moving need — can save you money right from the start. It means you never need to pay for "more pump" than you actually require.

You'll find a "Buffalo" Pump to match your exact requirements, with complete assurance of the utmost efficiency, dependability, ease of maintenance and long-range economy. Just contact your nearest "Buffalo" engineering representative, or write us direct. We'll be glad to recommend the pump that's best-suited to your needs.

THE COMPLETE "BUFFALO" LINE ALSO INCLUDES: Heat Transfer Pumps, Close-Coupled Pumps, Sump Pumps and Raw Sewage Pumps. Special alloys available in all models.

Engineered into every "Buffalo" Pump is the famous "Q" Factor — the built-in QUALITY which provides trouble-free satisfaction and long life.

BUFFALO PUMPS
DIVISION OF BUFFALO FORGE CO.
171 Mortimer St. • Buffalo, N. Y.
Canada Pumps Ltd., Kitchener, Ont.
Sales Representatives in All Principal Cities
A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID



JL STEEL

"JAL-CON-WELD"

CONTINUOUS WELD PIPE

produced by pre-heating skelp in coil form to welding temperature of 2,450°F. and then welding by forcing edges together through pressure rolls. Another series of rolls reduces Jal-Con-Weld pipe to correct diameter.

JONES & LAUGHLIN ANNOUNCES

"JAL-CON-WELD"

superior quality continuous weld pipe produced on two modern mills at Aliquippa, Pa.

Jones & Laughlin, the modern steel company, is proud to announce another major addition to productive capacity, two modern continuous weld pipe mills costing a total of $18,000,000.

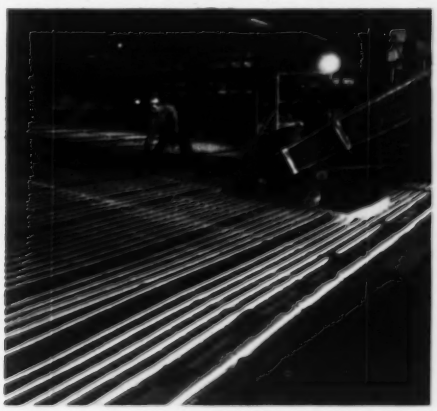
Jal-Con-Weld, the high quality pipe produced on these outstanding facilities, is available in sizes from ½ inch through four inches.

The continuous weld process utilizes skelp in coil form. Weld is formed by pressure rolls, under ideal temperature conditions. Before skelp enters the welding pass, a jet of air is blown on the edge to remove scale and increase temperature for a stronger weld.

As a major integrated steel company, J&L is able to control pipe quality from ore through finished product. This control includes complete testing by skilled personnel using the most modern equipment.

This added J&L capacity means faster service when you need it. Your J&L distributor will be able to furnish top quality welded pipe in the sizes you need for any job. Get the facts from your distributor, or write direct to Jones & Laughlin, 3 Gateway Center, Pittsburgh 30, Pa.

Most recent addition at the Jones & Laughlin Aliquippa works, this continuous weld mill utilizes J&L quality controlled skelp coils ranging in weight from 2,500 to 3,800 pounds. Material handling is completely automatic in the mill.



Finishing operations include cutting to proper length, straightening, facing, threading and hot-dip galvanizing. A series of inspections includes hydrostatic testing in modern Schloemann testers, two of which have been installed on each mill.

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

POWELL

world's largest family of valves

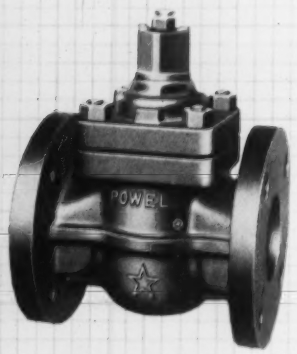


Fig. 2201 - Semi-steel Lubricated Plug Valve for 175 pounds W.O.G. Single gland type. Sizes 1" to 4". Can be supplied with screwed ends. Other types and higher pressure valves are available.

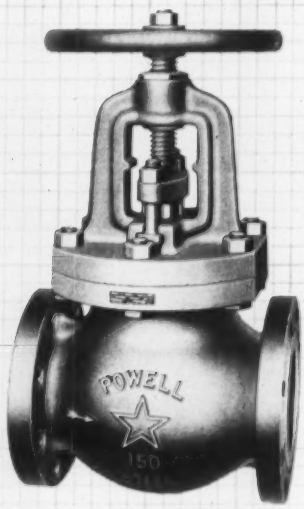


Fig. 1531 - Steel Globe Valve for 150 pounds W.S.P. Outside screw rising stem and yoke. Powell Steel Valves are available for pressures through 2500 pounds.

Fig. 1832 - Small Stainless Steel Gate Valve for 200 pounds W.P. Screwed-in bonnet, inside screw rising stem, accurately guided solid wedge disc. Also made in Nickel and Monel Metal.

Fig. 512 - Small Bronze Gate Valve for 150 pounds W.S.P. Inside screw non-rising stem. Solid wedge disc. Can also be supplied with flanged ends.

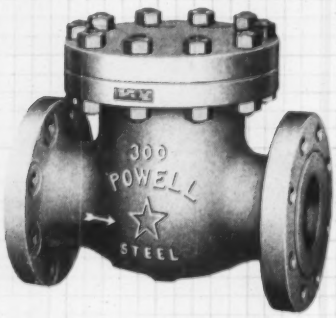
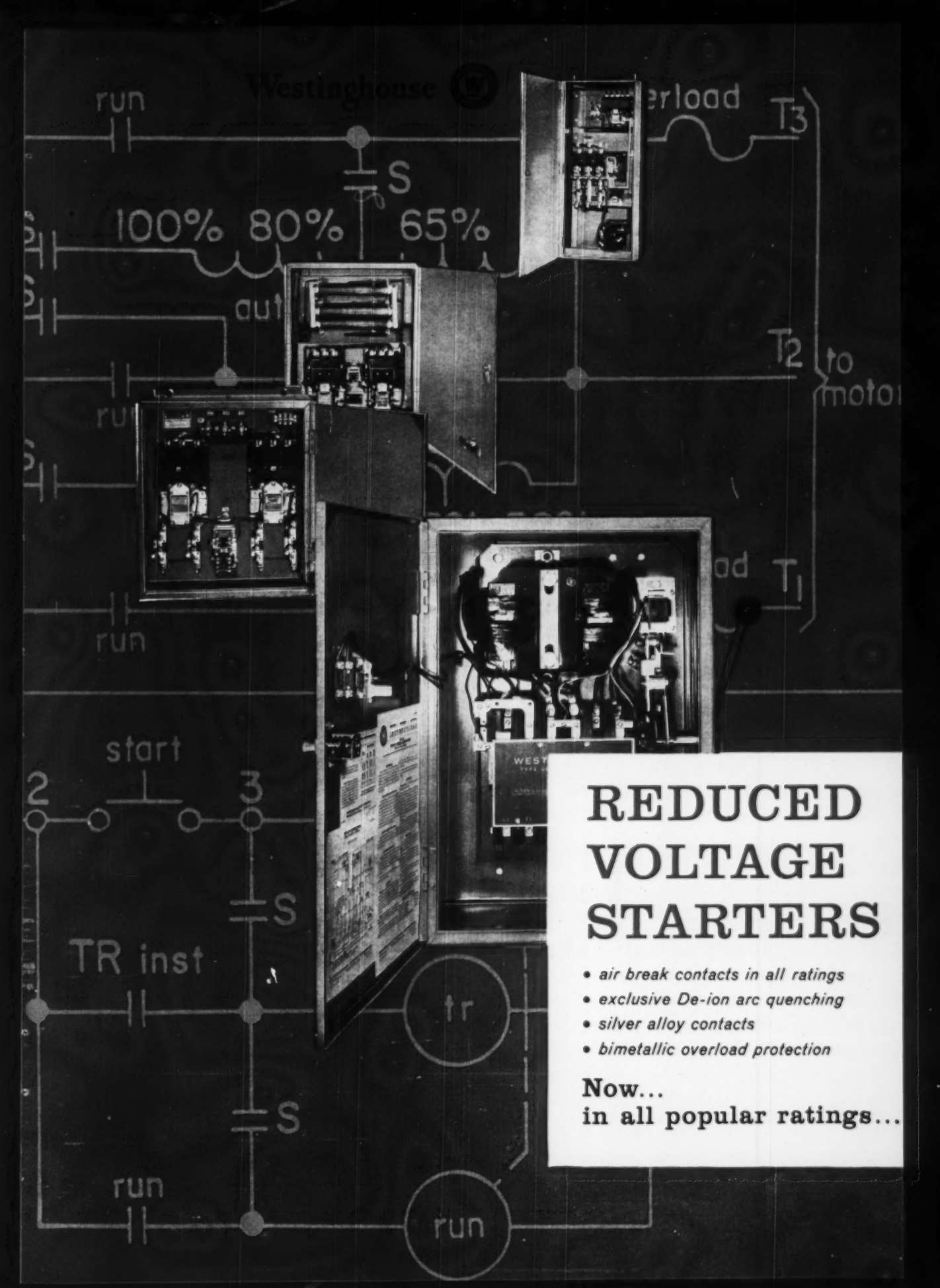


Fig. 3061A - Newly designed Steel Swing Check Valve for 300 pounds W.S.P. Has straight flow through area when disc is in wide open position.

Fig. 1444 - Large Iron Body Bronze Mounted Gate Valve for 125 pounds W.S.P. Outside screw rising stem and yoke, double wedge disc. Also available with solid wedge disc.

NO MATTER WHAT your flow control requirements, Powell offers more kinds or types of valves, available in the largest variety of metals and alloys. Powell distributors, located in all principal cities, maintain inventories to fill almost any need. For special engineering problems, write direct to:

THE WM. POWELL COMPANY • *Dependable Valves Since 1846* • **Cincinnati 22, Ohio**



REDUCED VOLTAGE STARTERS

- *air break contacts in all ratings*
- *exclusive De-ion arc quenching*
- *silver alloy contacts*
- *bimetallic overload protection*

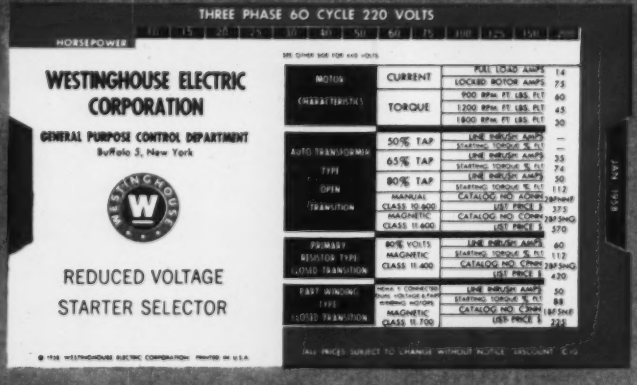
Now...
in all popular ratings...

Westinghouse REDUCED VOLTAGE STARTERS

IMMEDIATE DELIVERY FROM THESE WESTINGHOUSE DISTRIBUTORS

No waiting... no delays. A quick phone call to your nearby Westinghouse distributor gives you prompt delivery and service on the Westinghouse Reduced Voltage Starter you need.

J-22134-2



GET YOUR FREE WESTINGHOUSE STARTER APPLICATION SLIDE RULE

The Westinghouse starter application slide rule is just the "ticket" for easily determining within seconds the exact reduced voltage starter you need for any particular application. Simple to use, with a minimum amount of information required, it will save you considerable time in the accurate selection of all reduced voltage starters.

To obtain your free Westinghouse starter application slide rule, merely phone or write the distributor nearest you whose name and address appear on the following pages. Your free slide rule will be mailed to you immediately.

FROM THESE WESTINGHOUSE DISTRIBUTORS . . . "OFF THE SHELF" SERVICE FOR ALL YOUR REDUCED VOLTAGE STARTER NEEDS

ALABAMA

BIRMINGHAM
Moore-Handley
AL 2-4121

MOBILE
Moore-Handley
HE 3-7411

MONTGOMERY
Moore-Handley
AM 3-5534

ARIZONA

PHOENIX
Westinghouse Electric Supply Co.
1110 North 21st Avenue
AL 8-8211

ARKANSAS

LITTLE ROCK
Westinghouse Electric Supply Co.
119 Sherman Street
FRanklin 2-5154

CALIFORNIA

HAYWARD
Westinghouse Electric Supply Co.
21612 Western Boulevard
EL 1-6442

LOS ANGELES 54
Westinghouse Electric Supply Co.
905 East Second Street
MAdison 9-4161

NORTH HOLLYWOOD
Westinghouse Electric Supply Co.
13213 Sherman Way
POplar 5-8916 STanley 7-2578

OAKLAND
Westinghouse Electric Supply Co.
711 East 8th Street
TE 4-9900

SAN JOSE
Westinghouse Electric Supply Co.
292 Stockton Avenue
CYpress 7-5929

TULARE
Turnupseed Electric Service, Inc.
340 East Inyo MUrdock 6-3401

COLORADO

DENVER
Mine & Smelter Supply Co.
3800 Race Street
KEystone 4-3111

Wazee Electric Co.
2020 West Barberry Place
AComa 2-4533

DISTRICT OF COLUMBIA

WASHINGTON 18
Westinghouse Electric Supply Co.
935 Brentwood Road, N. E.
HUdson 3-8974

FLORIDA

JACKSONVILLE 6
Westinghouse Electric Supply Co.
545 East Fourth Street
ELgin 3-7431

GEORGIA

ALBANY
Westinghouse Electric Supply Co.
610 North Washington Street
HE 2-1285

SAVANNAH
Westinghouse Electric Supply Co.
580 Indian Street ADams 3-9682

IDAHO

BOISE
Westinghouse Electric Supply Co.
318 South Capitol Boulevard
P. O. Box 1518 2-3531

ILLINOIS

CHICAGO 7
Westinghouse Electric Supply Co.
113 North May Street
TAylor 9-5000

DANVILLE
Westinghouse Electric Supply Co.
603 North Gilbert Street 1901

ROCKFORD
Westinghouse Electric Supply Co.
2121-15th Street 8-2471

INDIANA

EVANSVILLE
Westinghouse Electric Supply Co.
1251 Diamond Avenue HA 3-1152

INDIANAPOLIS 7
Westinghouse Electric Supply Co.
1560 Stadium Drive ME 2-3301

TERRE HAUTE
Walker Electric Supply Co., Inc.
124-130 South Third Street
C-1385

IOWA

DAVENPORT
Westinghouse Electric Supply Co.
402 East Fourth Street 3-9966

DES MOINES
Westinghouse Electric Supply Co.
2515 Dean Avenue AM 2-3181

FORT DODGE
Iowa Electric Supply Co.
1012 First Avenue, North 7-2311

WATERLOO
Westinghouse Electric Supply Co.
300 West Third Street
ADams 4-4679

KANSAS

WICHITA
Westinghouse Electric Supply Co.
2940 South Minneapolis HO 4-5394

KENTUCKY

LOUISVILLE
Tafel Electric and Supply Co.
333 East Brandeis Street
MElrose 6-1381

LOUISIANA

BATON ROUGE
Westinghouse Electric Supply Co.
2511 Michelli Drive
EL 7-0603-4-5

MARYLAND

BALTIMORE
Tristate Electrical Supply Co., Inc.
HOpkins 7-5600

CUMBERLAND
Tristate Electrical Supply Co., Inc.
PArkview 2-0060

FREDERICK
Tristate Electrical Supply Co., Inc.
MOnument 2-2136

HAGERSTOWN
Tristate Electrical Supply Co., Inc.
REgent 3-1212

MASSACHUSETTS

PITTSFIELD
Electric Supply and Repair Co., Inc.
48 Pearl Street 2-1539

MINNESOTA

DULUTH
Westinghouse Electric Supply Co., Inc.
230 Lake Ave. S. RA 7-7423

MINNEAPOLIS 15
Westinghouse Electric Supply Co.
515 South Seventh Street
FEderal 8-7001

ST. PAUL 1
Westinghouse Electric Supply Co.
253 East Fourth Street CA 7-6581

MISSOURI

JOPLIN
Continental Electric Co.
415 Junge Boulevard MA 4-2417

KANSAS CITY
Continental Electric Co.
1321 West 13th Street GR 1-1180

MONTANA

BUTTE
Westinghouse Electric Supply Co.
949 South Montana Street 2-2374

KALISPELL
Industrial Supply Co.
175 East N. R. R. Street
SK 6-5900

NEBRASKA

OMAHA
Westinghouse Electric Supply Co.
117 North 13th Street HA 8700

NEVADA

LAS VEGAS
Osborne Electric Supply Co., Inc.
835 West Bonanza Road
DUdley 2-7393

NEW JERSEY

NEWARK 5
Westinghouse Electric Supply Co.
528 Ferry Street MI 2-3450

TRENTON 9
Westinghouse Electric Supply Co.
745 East State Street OWen 5-5421

NEW MEXICO

ALBUQUERQUE
Westinghouse Electric Supply Co.
816 First Street, N.W. CH 3-3708

NEW YORK

BUFFALO 2
Buffalo Electric Co., Inc.
75 West Mohawk Street WA 4420

JOHNSON CITY
Westinghouse Electric Supply Co.
419 Grand Avenue 9-1561

POTSDAM
Van Ness Co., Inc
29 Depot Street 9328

SYRACUSE
Westinghouse Electric Supply Co.
961 West Genesee Street 74-3331

NORTH CAROLINA

RALEIGH
Electric Motor & Repair Co.
P. O. Box 1950 TEmple 3-2781

NORTH DAKOTA

FARGO
Westinghouse Electric Supply Co.
405-14th Street, North 2-4446

OHIO

CLEVELAND 14
H. Leff Electric Co.
2341 Payne Avenue TOwer 1-7400

Westinghouse Electric Supply Co.
1809 East 22nd Street TOwer 1-5660

Westinghouse Electric Supply Co
700 East 165th Street IVanhoe 1-7840

COLUMBUS 15
Westinghouse Electric Supply Co.
266 North Fourth Street
CApital 1-5571

YOUNGSTOWN 1
The Phoenix Electric Co.
533 Lincoln Avenue Riverside 4-4519

OKLAHOMA

OKLAHOMA CITY
Westinghouse Electric Supply Co.
850 N.W. Second CEntral 2-7101

TULSA
Westinghouse Electric Supply Co.
307 East Brady DI 3-7155

OREGON

EUGENE
Tillman & Booth, Inc.
215 West Fifth DI 5-3301

KLAMATH FALLS
Tillman & Booth, Inc.
Sixth & Broad TU 4-4171

East Side Electric Co.
P. O. Box 190
TUxedo 4-3184

MEDFORD
Westinghouse Electric Supply Co.
P. O. Box 1152 SP 3-4556

PORTLAND 9
Westinghouse Electric Supply Co.
815 N. W. 12th Avenue CA 2-9851

PENNSYLVANIA

CHAMBERSBURG
Tristate Electrical Supply Co., Inc.
CO 4-4631

PHILADELPHIA
Westinghouse Electric Supply Co.
141 North 11th Street WA 2-8950

PITTSBURGH 12
Westinghouse Electric Supply Co.
209 West General Robinson Street
FA 2-5500

SOUTH CAROLINA

COLUMBIA
Electric Motor and Repair Co.
P. O. Box 806 ALpine 2-2181

TENNESSEE

CHATTANOOGA
Mills & Lupton Supply Co.
749 East 12th Street AM 6-6171

KNOXVILLE
Westinghouse Electric Supply Co.
403 East Fifth Avenue 4-8644

MEMPHIS
Shelby Electric Co., Inc.
112 East E. H. Crump Boulevard
Whitehall 8-1546

Westinghouse Electric Supply Co.
845 North Main Street JA 7-9431

NASHVILLE
Tafel Electric & Supply Co.
401 Sixth Avenue, South CH 2-7305

TEXAS

BEAUMONT
Westinghouse Electric Supply Co.
1655 Louisiana Street
TErminal 3-6333

CORPUS CHRISTI
Westinghouse Electric Supply Co.
110 North Staples Street
TU 2-3351

EL PASO
Triangle Electric Supply Co.
333 West San Antonio Street
KEystone 3-1611

HOUSTON
Westinghouse Electric Supply Co.
1903 Ruiz CA 5-1341

LUBBOCK
Westinghouse Electric Supply Co.
605 Main Street POrter 5-6396

SAN ANTONIO 6
The Perry Shankle Co.
1801 South Flores Street
CA 6-5191

Westinghouse Electric Supply Co.
1211 East Houston Street
CA 7-9271

UTAH

OGDEN
Westinghouse Electric Supply Co.
2660 Lincoln Street
EXport 4-2691

SALT LAKE CITY
Westinghouse Electric Supply Co.
210 Rio Grande Street
DAvis 2-2441

VIRGINIA

HARRISONBURG
Tristate Electrical Supply Co., Inc.
4-7514

RICHMOND
Westinghouse Electric Supply Co.
511 East Byrd Street MI 3-0111

ROANOKE
Westinghouse Electric Supply Co.
19th Street & Salem Avenue, S. W.
Diamond 4-3271

WASHINGTON

SEATTLE 4
Westinghouse Electric Supply Co.
1051 First Avenue, South MAin 3-7001

SPOKANE
Westinghouse Electric Supply Co.
N. 1023 Monroe Street FA 8-3371

TACOMA 2
Westinghouse Electric Supply Co.
1325 South Tacoma Way GR 4-9476

WISCONSIN

GREEN BAY
Westinghouse Electric Supply Co.
619 Main Street HEmlock 5-3751

MADISON
Westinghouse Electric Supply Co.
110 North Thornton Avenue
AL 5-4867

MILWAUKEE
Westinghouse Electric Supply Co.
546 North Broadway BR 6-1800

J-22134-3

MINUTEMAN!

Your steel service center starts delivery even as you place your order!

In every way, your local steel distributor is geared to keeping production lines rolling.

He's ready to rush the amount, quality, size and shape of steel to meet almost any conceivable demand—on the double. He's your on-the-spot insurance against the plant shutdowns and lost contracts that can be caused by in-plant steel shortages.

On a regular basis, his facilities, stocks and fast delivery service can be integrated with your production needs. He is, truly, the service center of the steel industry. And he's only a phone call away.

Call him for any quantity of Weirkote continuous-process zinc-coated sheets, Weirzin electrolytic zinc-coated sheets, hot- or cold-rolled sheets or any type of steel you may need for any type of production job.

WEIRTON STEEL COMPANY

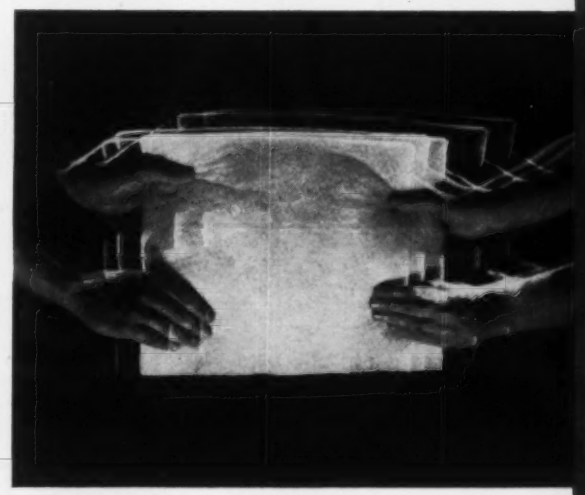
WEIRTON STEEL COMPANY

WEIRTON, WEST VIRGINIA

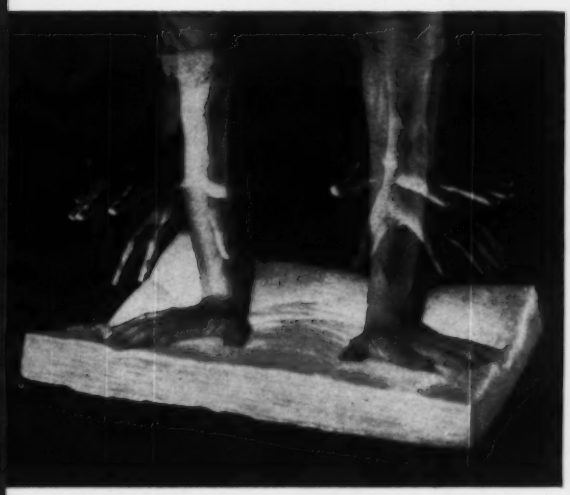
a division of

NATIONAL STEEL CORPORATION

Try these 3 tests with Pittsburgh Superfine Fiber Glass Insulation



PULL IT—see how strong Pittsburgh Superfine is! It's built to last wherever you install it. It retains this same strength indefinitely. Won't disintegrate or rot with age.



PRESS IT—and see how it returns to its original shape. You can compress Pittsburgh Superfine for long periods of time, yet it will always spring back to its former shape!

GIVE IT A BEATING—and see how Pittsburgh Superfine absorbs the shock, and comes back. Pittsburgh Superfine loves rough handling.

PITTSBURGH SUPERFINE FIBER GLASS is great for insulating against heat or cold or noise. It's lightweight, cuts easily to correct size . . . is rot-proof, fire-resistant . . . handles easily, avoids skin irritation . . . saves installation time. Try it!

For complete information on Pittsburgh Superfine, call your nearest PPG Sales Office, or write to *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Penna.*

PITTSBURGH SUPERFINE INSULATION IS A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

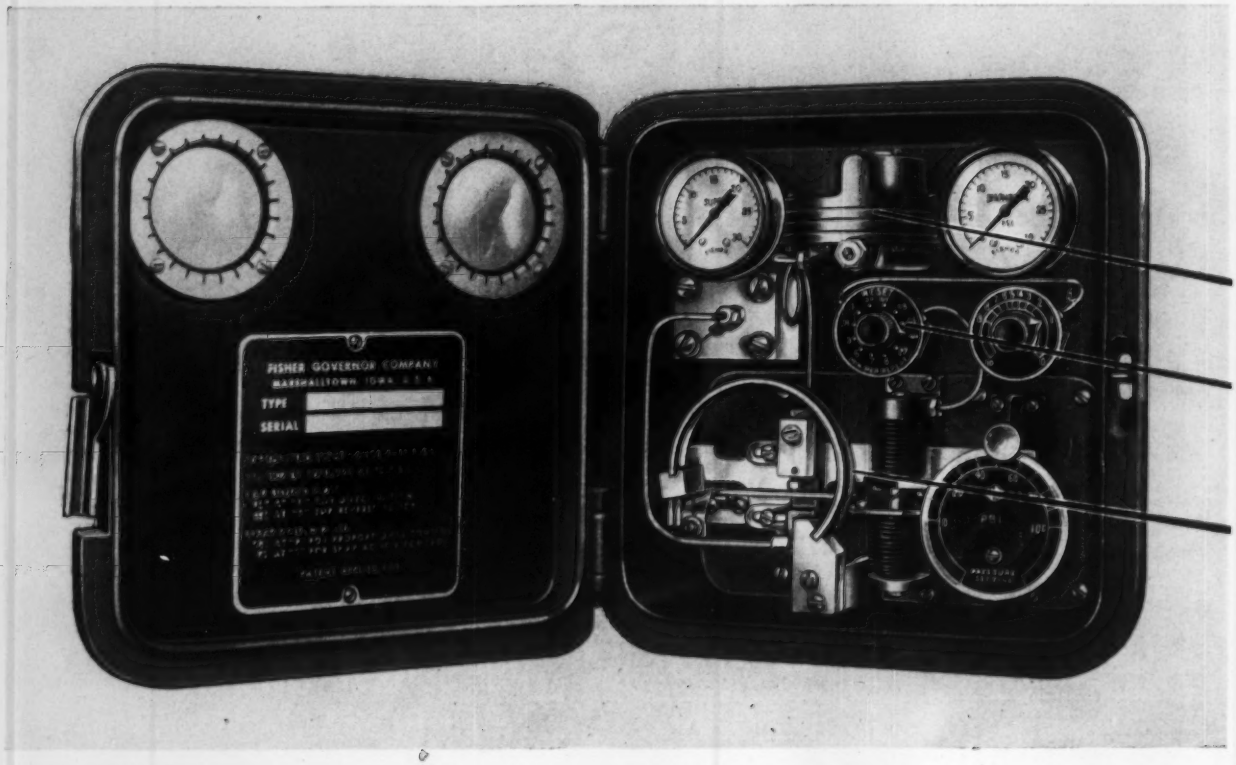
Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, Minneapolis, New York, Philadelphia, Pittsburgh and St Louis

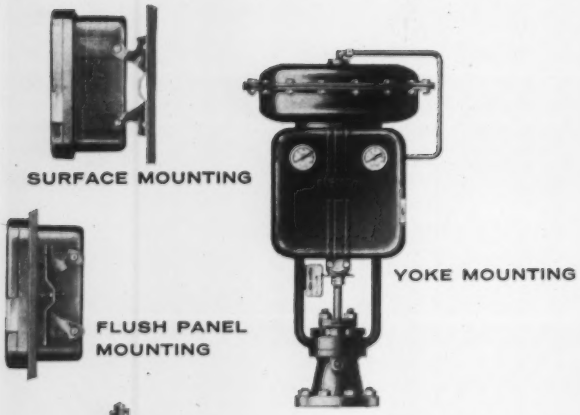
75th ANNIVERSARY 1883—1958 PPG

SYMBOL OF SERVICE FOR SEVENTY-FIVE YEARS

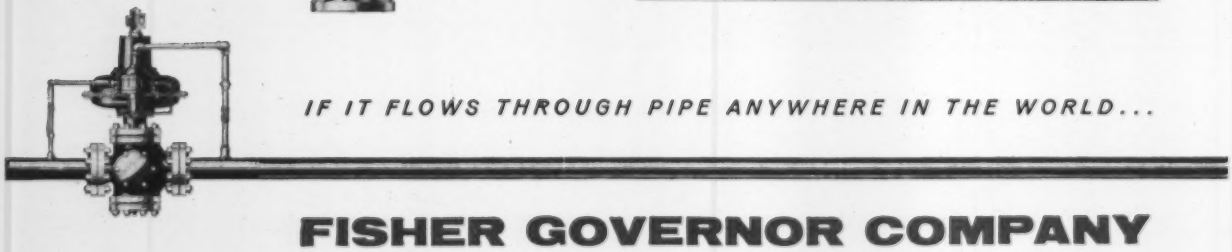
PITTSBURGH PLATE GLASS COMPANY

Basic Simplicity...faster





PERFORMANCE DATA	
Test	**Results**
Air or Gas Consumption with 15 psi Output Pressure	Minimum at 10 or 0 Proportional Dial Setting—2 cfh Maximum at 5 Proportional Dial Setting—23 cfh
Resolution Sensitivity	Minimum Change Required in Measured Variable to Produce an Effective Movement of Final Control Element is 0.1% of Bourdon Tube Rating.
Repeatability	Ability of Wizard to Reproduce Its Output Signal for a Given Pressure Setting is 0.5% of Bourdon Tube Rating
Resonant Frequency	Unaffected at Usual Motor and Turbine Speeds.
Temperature Effects	Under Cold Box Test at —20° and Simulated Sun Test from 80° to 212°F Control Pressure Remained Within ±1% of Bourdon Tube Rating.



IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD...

FISHER GOVERNOR COMPANY

response...greater stability

the WIZARD II PRESSURE CONTROLLER

with New and Improved Features

1. **VOLUME RELAY** for faster response to pressure changes.
2. **RESET FEATURE** for greater stability and pin point control, assuring perfect metering, even on multi-stage meter runs.
3. **WIDE RANGE** brass, steel or stainless steel Bourdon tubes cover a range of from 25 to 10,000 psi. Bellows assemblies for low pressure regulation in ranges from 0 to 25 psi.

Again FISHER engineering produces features the industry needs to do a better job

The Wizard II has been designed to specifically meet the demands of modern, complex systems requiring closer control. The Wizard II retains all of the basic simplicity, accuracy and dependability of the Wizard 4100U, plus its own exclusive features.

The new design consists of two sub-assemblies encased in a weather proof die cast aluminum housing which is provided with a ¼" pipe threaded vent for gas service. Either assembly can be removed without disturbing line connections.

The upper assembly consists of two gauges, relay and proportional band adjustment. The lower assembly includes the set point adjustment, proportional bellows, Bourdon tube and nozzle. Each assembly is assembled and calibrated before mounting in the case. The case can be mounted on a flush panel, a wall or on the yoke of the control valve.

Careful and exhaustive tests have conclusively proved that the Wizard II measures up to rigid Fisher standards.

A completely descriptive and illustrated bulletin on the Wizard II is yours for the asking. Write for Bulletin No. D-4150.

The original Wizard I is still available for those applications not requiring volume relay and reset features.

CHANCES ARE IT'S CONTROLLED BY...

FISHER® Controls

SINCE 1880

Marshalltown, Iowa / Woodstock, Ontario

Architect-Owner says:

"I chose Chase copper tube over any other plumbing for the Nautilus Motor Inn"

New Cape Cod Motel 100% Equipped with Chase Copper Tube for Water Supply and Drainage Lines

The Nautilus Motor Inn, Woods Hole, Massachusetts is one of the newest vacation spots on Cape Cod. Uniquely, perhaps, it is owned and operated by the architect who designed it—E. Gunnar Peterson. For his own property, Mr. Peterson could have chosen any material for the plumbing—*but he chose Chase copper tube over any other pipe!*

The Chase tube was used in underground supply lines, all interior drainage, and hot and cold domestic water lines, to make another outstanding installation that is 100% Chase-equipped.

Wherever longer, better water and waste line service is important—and that is in every job you plan—Chase LIFELINES® of Copper Tube will far outlast any rustable metal piping. Copper never rusts, won't clog—**and costs no more than pipe that will cause you trouble.** Ask your Chase wholesaler for details.

Nautilus Motor Inn, Woods Hole, Massachusetts, 100% equipped with LIFELINES of Chase Copper Tube. Architect-Owner, E. Gunnar Peterson; Plumbing by Thomas Wood, Falmouth, Mass.; Chase Copper Tube supplied by R. B. Corcoran Co., Hyannis.

Chase®

BRASS & COPPER CO.
WATERBURY 20, CONN.
Subsidiary of
Kennecott Copper Corporation

The Nation's Headquarters for Brass, Copper and Stainless Steel

Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York (Maspeth, L.I.) Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

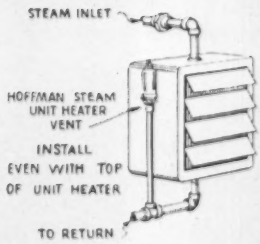
FOR MAXIMUM EFFICIENCY

USE HOFFMAN VENTS

To get top performance on Steam Unit Heaters, Steam Heating Systems, Steam Process Work, Hot Water Heating Systems, Domestic Water, Summer-Winter Units—Water Process work, air must be eliminated. Hoffman Vents are designed to vent the air accumulations so that the equipment will function effectively.

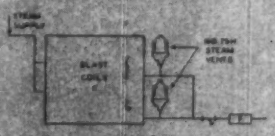
Installation of these vents now on old or new jobs will insure the maximum efficiency of the equipment.

NO. 74 VENT FOR STEAM UNIT HEATERS



To insure best results, Steam Unit Heaters must be "piping hot." The No. 74 vent is a float type vent especially designed for use with Steam Unit Heaters. This vent will expel the air as it accumulates.

Size Connection: ¾" male, ½" female. Maximum Operating Pressure: 35 P. S. I.

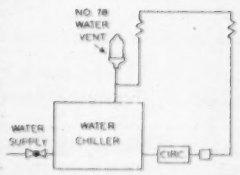


NO. 75 H STEAM VENT

An air vent for systems, supplied with steam from constant source such as District Heating, Pressure Reducing Stations and Zoned Systems.

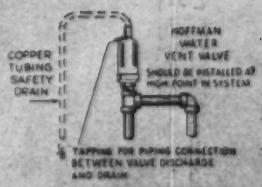
Size Connection: ¾" male, ½" female. Venting Pressure: 10 P. S. I. System Pressure: 15 P. S. I.

NO. 78 HIGH PRESSURE WATER VENT



Designed for use on high pressure hot or cold water mains and process applications. Cast brass body. Safety drain connection for discharging moisture entrained in the vented air. Has drain tube fitting and ferrule for ¼" O.D. tubing.

Size Connection: ¾" male, ½" female. Maximum Operating Pressure: 150 P. S. I.—will withstand hydrostatic pressures of 450 P. S. I.


COPPER TUBING SAFETY DRAIN
HOFFMAN WATER VENT VALVE
SHOULD BE INSTALLED AT HIGH POINT IN SYSTEM
TAPPING FOR PIPING CONNECTION BETWEEN VALVE DISCHARGE AND DRAIN

NO. 79 WATER VENT

For good circulation on any water system (hot or cold) it is necessary to let the air out. The No. 79 vent is designed for use on hot or cold water mains and process applications. Tapped at top for ⅛" I. P. S. safety drain connection for discharging moisture entrained in the vented air.

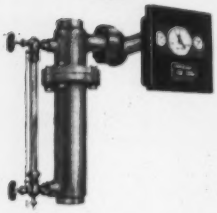
Size Connection: ¾" male, ½" female. Maximum Operating Pressure: 75 P. S. I.

HOFFMAN SPECIALTY MFG. CORP.

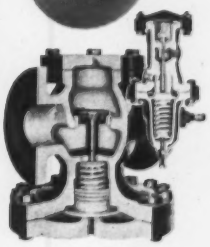
1700 W. 10th Street, Indianapolis 7, Indiana

Valves, Traps, Vacuum and Condensation Pumps, Forced Hot Water Heating Systems, stocked and sold by leading Wholesalers of Heating and Plumbing Equipment.

SPLIT-BODY VALVES



LEVEL CONTROLLERS



PRESSURE REGULATORS

DIAPHRAGM CONTROL VALVES

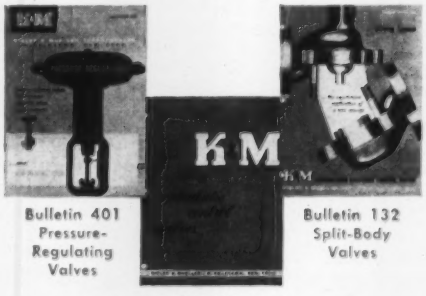
KEEP A FIRM HAND ON FLUID CONTROL WITH K&M VALVES ALL ALONG THE LINE

From the complete display on the K & M shelf, you can select the best type of valve for every control job in the process line. You can, in fact, standardize entirely on K&M. That means simplified specification, ordering, maintenance.

Especially maintenance. K & M engineers have put consistent design emphasis on field interchangeability of components. In a pinch, you can "borrow" an inner valve or a topworks assembly from a pressure regulator for use with a diaphragm motor valve. That's what we mean by interchangeability.

And because the K & M line is so diverse and inclusive, our field representatives are free to make unbiased suggestions on the type of valve best suited to your requirements. That can often mean substantial dollar savings all along the process line.

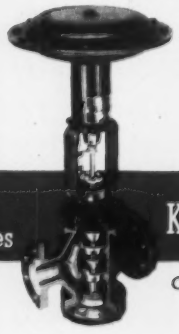
THREE TECHNICAL BULLETINS GIVE THE IMPORTANT FACTS AND FIGURES. THEY'RE YOURS FOR THE ASKING.



Bulletin 401 Pressure-Regulating Valves

Bulletin 132 Split-Body Valves

Bulletin CV53 Standard Diaphragm-Operated Control Valves



K&M

diaphragm control valves

KIELEY & MUELLER, INCORPORATED

Our 79th Year

Oldest Pressure and Level Control Valve Manufacturer
64 Genung Street, Middletown, New York

S.A. 1721

NEW IMPROVED

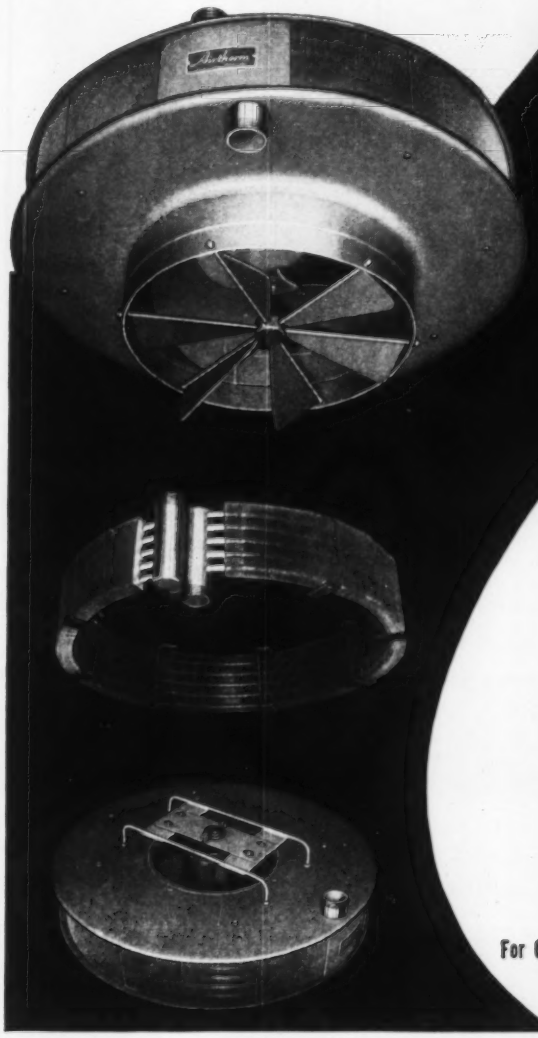
Airtherm

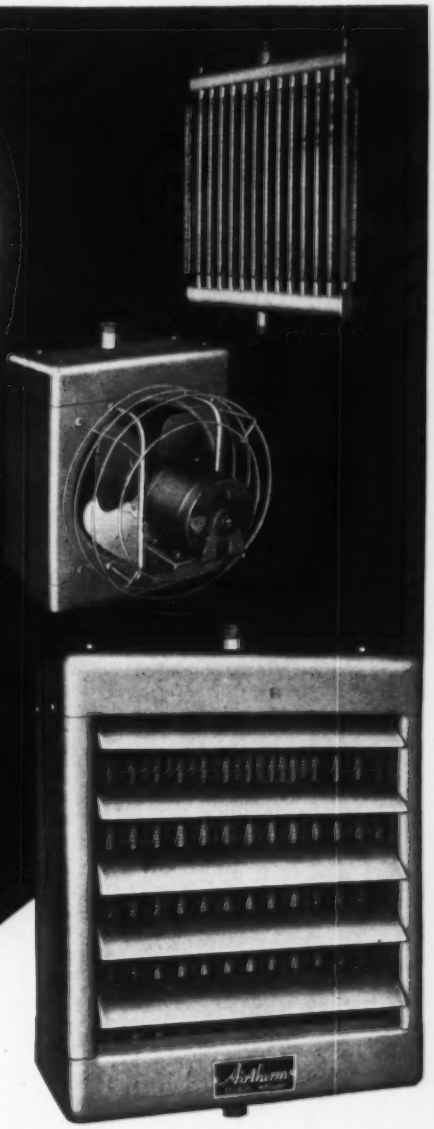
PROPELLER FAN

UNIT HEATERS

FOR STEAM OR HOT WATER

A SIZE FOR EVERY REQUIREMENT





The new Airtherm line incorporates 22 completely redesigned vertical units and 24 improved horizontal units, ranging from 18,000 to 555,000 BTU per hour, with a choice of outlet diffusers to cover practically every air distribution pattern and mounting height. Silent operation is assured by resiliently mounted motors, properly designed fans and casings, and attention to face and outlet velocities. All fans are expertly positioned, balanced and tested. Each unit is tested and rated for performance in strict accordance with the Standard Test Code of the industry. Only brand name, continuous duty motors, especially made for the purpose, are used and mountings are designed for efficient cooling and easy servicing. Rugged coils are formed by hydraulically expanding copper tubing into plate type aluminum fins, each with its own collar, providing increased heat transfer and wide, even spacing to reduce clogging. All coils are tested and tagged for 500 p.s.i. hydrostatic pressure. Casings are phosphatized to insure a long, rust-free life for the attractive baked enamel hammer tone finish.

For Complete Specifications Including a Guide for Selection and Application, Write:

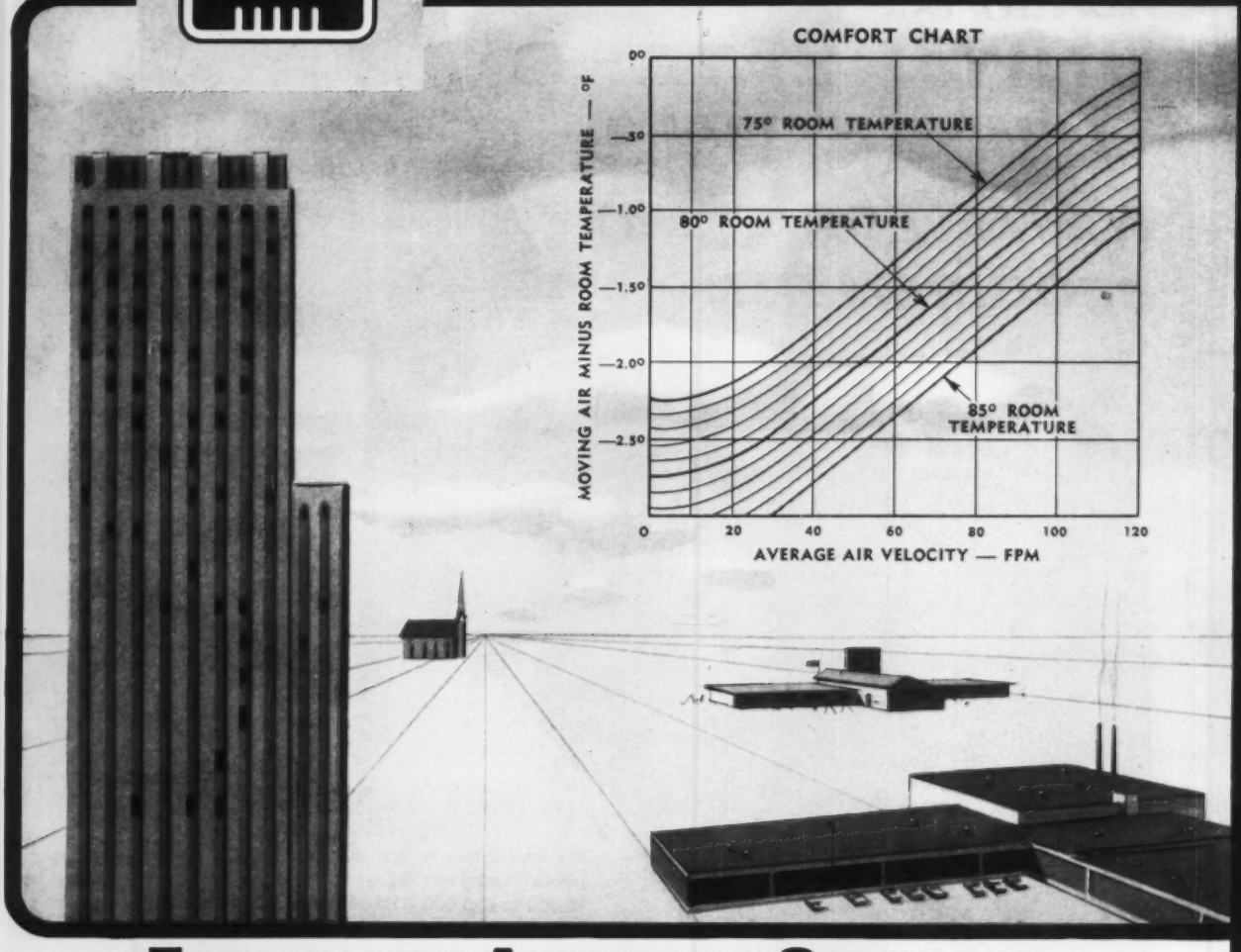
AIRTHERM MANUFACTURING CO.

702 S. SPRING AVE. • ST. LOUIS 10, MO.

THE MARK OF QUALITY

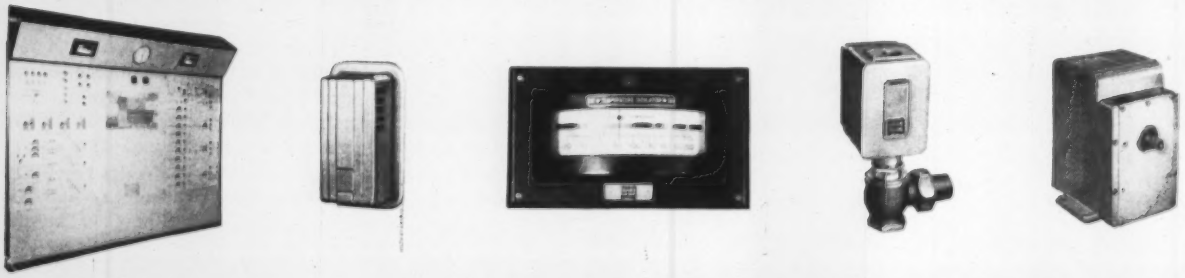
BARBER COLMAN

You can guarantee will



ELECTRIONIC AUTOMATIC CONTROLS...

A complete line of automatic controls for air conditioning, heating, and ventilating service.



ONE SOURCE...UNDIVIDED RESPONSIBILITY....

every air conditioning job conform to this comfort chart*

* **When you combine Electrionic Automatic Controls with Uni-Flo Engineered Air Distribution**

It is impossible to provide uniformly comfortable air conditioning without the correct correlation between air movement and room temperature. When occupants complain that a room is alternately too warm, too cool, or too drafty, you can be sure that the correct relationship between air distribution and temperature control has not been met.

The importance of this relationship cannot be overemphasized because an individual's comfort is affected by:

1. **Room temperature.**
2. **Velocity of conditioned air being introduced to the room.**
3. **Temperature of moving air in relation to average air temperature in the room.**

The scientifically correct relationship is plotted on the Barber-Colman Comfort Chart shown at the left. This requires closely coordinated functioning of the system's automatic controls and its air distribution units.

Failure to meet the Comfort Chart requirements is the cause of complaints and costs long after the job is "done." This is the point at which it is difficult to establish responsibility for the faults in the system.

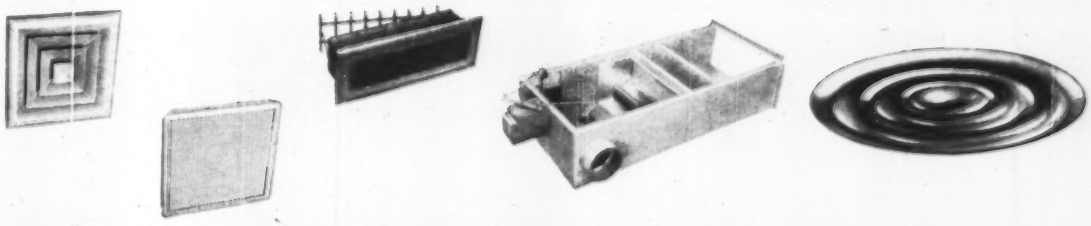
When Barber-Colman Electrionic controls and Uni-Flo engineered air distribution are combined on your job, you have complete assurance that the system will function correctly, providing constant comfort to the occupants of the building at all times. Barber-Colman guarantees this and assumes complete responsibility to see that it is accomplished.

Only Barber-Colman offers you years of combined experience in both automatic controls and air distribution — and assumes the *undivided* responsibility for delivering ideal indoor weather. Architect, engineer, owner, and occupant benefit by having this important obligation successfully discharged by a single supplier.

FOR COMPLETE INFORMATION ask for new fully illustrated Bulletin F-8326 which details the benefits of temperature control and air distribution combinations available through Barber-Colman.

UNI-FLO ENGINEERED AIR DISTRIBUTION...

A complete line of air distribution products for better air handling.



....BARBER-COLMAN COMPANY

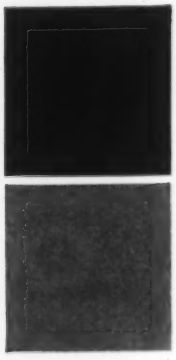
Dept. I, 1601 Rock Street, Rockford, Illinois

TOTAL COVERAGE

Torrington offers the most complete line of fans in the United States. Applications range from small precision fans for electronic cooling to the largest heavy-duty requirements of industrial and residential air moving—in diameters from 1½" to 52".

Torrington blower wheels are available in diameters from 1½" to 16". A full range of designs includes standard single and double inlet Airotors, in both continuous and individually-bladed construction.

In complete blower units, Torrington offers proved-out performance ratings on three full lines, the Vari-Basic line of belt driven and direct drive units, plus the revolutionary new mixed flow Radiax blower.



The result is TOTAL COVERAGE—the best "problem insurance" you could have. For complete data:

Talk to Torrington!

THE TORRINGTON MANUFACTURING COMPANY

TORRINGTON, CONNECTICUT • VAN NUYS, CALIFORNIA • OAKVILLE, ONTARIO

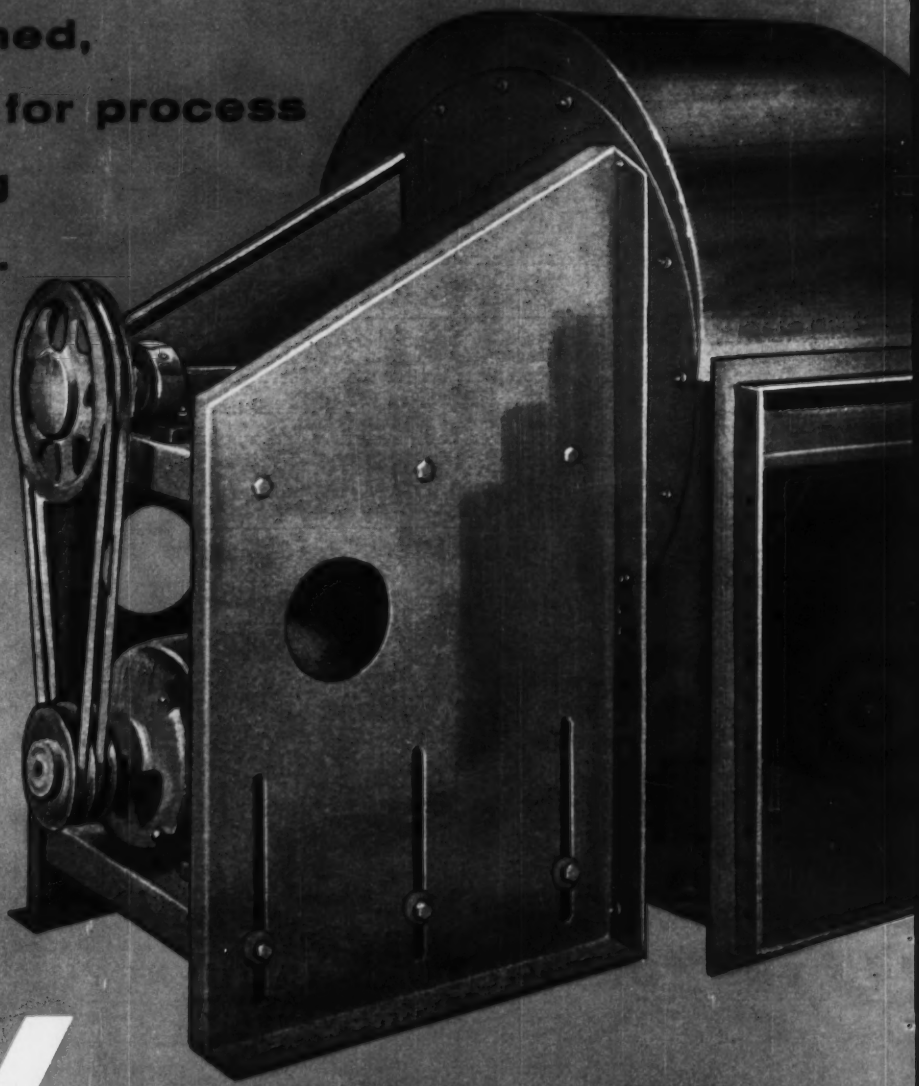
BIG

The BIG year for BIG performance

GENERAL PURPOSE FANS

. . . self-contained, portable units for process and ventilating applications . . .

From design through maintenance, present day air handling problems demand BIG performance from fans. And General Purpose Fans do the job, give you that BIG performance. They're made in four types, 12 basic sizes, with capacities from 160 to 19,070 Cfm; in both constant speed units with direct connected motors and adjustable speed units with V-belt drives and integral mounted motors; particularly for use with duct systems. Send for Bulletin 563.



nyb

THE NEW YORK BLOWER COMPANY

Sales offices: 3149 South Shields Avenue • Chicago 16

Kathabar® systems maintain spaces at 80 F and 55% RH, or lower, for processing, storage, and testing!

You can pick the best production weather you've ever had, and reproduce it every day of the year. You can set the exact storage temperatures and humidities which are ideal for your product. And in your testing lab, you can imitate any climate on earth.

All of this you can do economically with a Kathabar-engineered air conditioning system. In many applications, cooling can be accomplished with available water (e.g., a Kathabar system can reduce 72 F dew point air to 46 F dew point with 85 F cooling tower water). Refrigeration, when needed, is free to handle only sensible cooling with minimum tonnage and higher suction temperatures—without frost or duplicate coils. No overcooling or reheating necessary.

let's look at cases

This sampling of Kathabar installations will show you how effective and versatile a Kathabar system can be.

9 climates for candy

Candy's sold seasonally, but manufacturing economy demands uniform production throughout the year. A Chicago company uses Kathabar systems to store different types of candy in 9 separate zones. Humidities range from 12 to 50% RH; temperatures, 50 to 85 F.

zoned for profits

Another candy manufacturer spots individual Kathabar units and cooling units to fit the varied requirements of drying, chilling, polishing, coating, bottoming, packaging, storage, and comfort. One example of Kathabar-earned profits: polishing time cut in half.

ethical competition

In the high-volume, low-margin pharmaceutical industry, companies always seek new ways to reduce costs and improve quality control. One of the biggest companies achieves both with Kathabar systems in over 100 air conditioning zones. Outside weather can not interrupt processes. As a bonus, Kathabar systems deliver sterile air.

getting jets off the ground

The chemicals in solid rocket fuels are extremely hygroscopic, and must be dried before use. Kathabar systems protect their physical properties and insure accurate ballistic results. Process areas are maintained at precise conditions, even when hosed down frequently.

relieving printers' headaches

Kathabar systems keep printing papers from getting too wet or too dry; improve ink distribution and drying; eliminate the variables in plate-making. Printers earn new profits with more press time, fewer schedule upsets.

fast compressor assembly

Water vapor in a refrigerator compressor could cause obvious troubles. A Kathabar system enabled a large manufacturer to switch from batch to continuous drying—and cut production time, handling, and manpower.

who uses Kathabar systems

Kathabar systems make profits out of air for these industries:

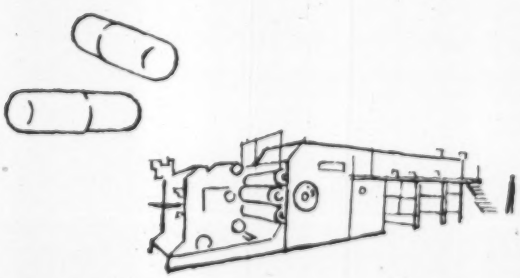
Atomic Energy	Machining
Breweries	Matches
Cake Mix	Marine
Candy	Meat
Cellophane	Offices
Cellulose	Ordnance
Cereals	Paper
Chemicals	Pharmaceuticals
Coffee	Plastics
Comfort	Printing
Compressors	Rockets
Cookies	Rubber
Electronics	Shellac
Explosives	Sugar
Film	Sanitaryware
Foundries	Testing
Gelatin	Textiles
Glass	Transformers
Glue	Transistors
Gum	Vacuum Tubes
Hospitals	Varnish
Hotels	Waterworks
Lacquer	Wire
Lenses	Yeast

how they use Kathabar systems

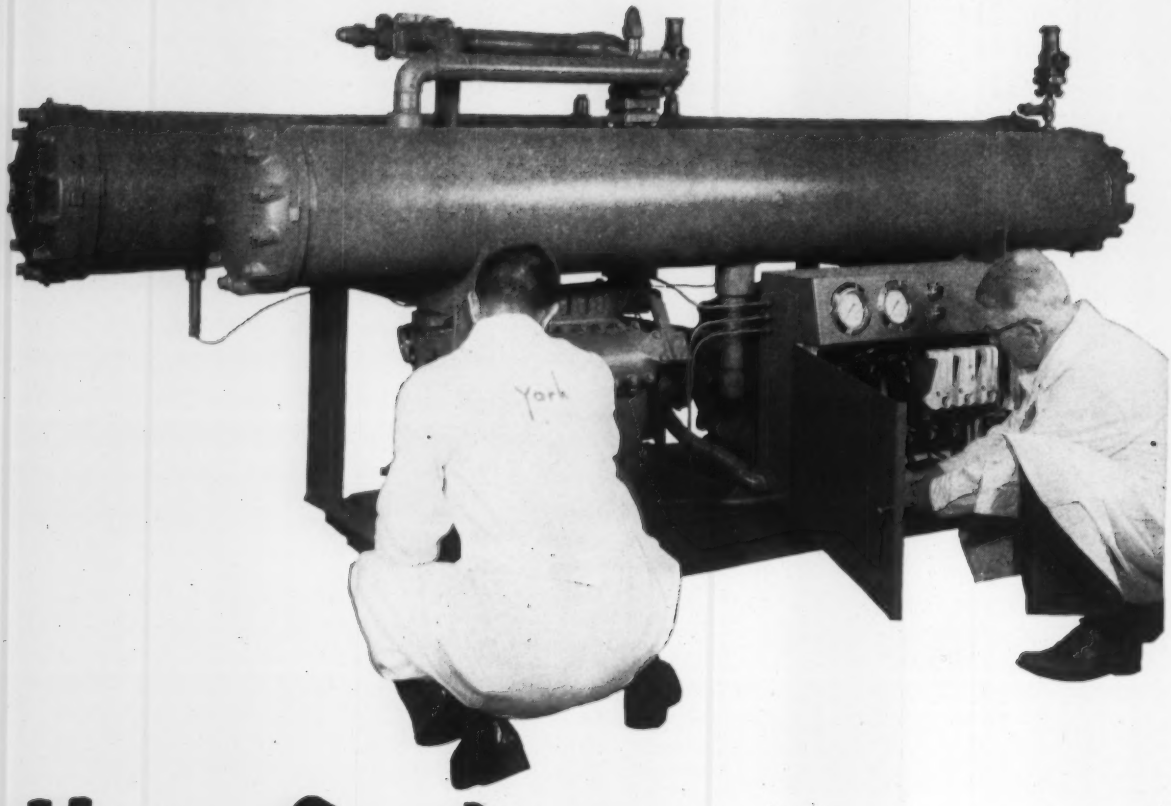
Many of these industries use Kathabar systems to maintain spaces at 80 F and 55% RH or lower. Others use them to (1) obtain continuous air at sub-freezing dry bulb and dew points; (2) eliminate condensation; (3) maintain spaces at specific low bacteria or mold count; and (4) improve drying processes.

send description of your problem

Air Conditioning and Drying Division
SURFACE COMBUSTION CORPORATION
2384 Dorr Street Toledo 1, Ohio



Kathabar systems by Surface



More Cooling

IN 20% LESS FLOOR SPACE WITH YORK PACKAGED WATER CHILLER!

Compact, Factory-Assembled Unit Installs Anywhere In The Building—Without Costly Installation!

York Packaged Water Chillers offer consultants, architects and building managements the first practical answer to the critical space/cost problems in air conditioning new buildings. Each complete, factory-assembled package features integrated arrangement of all components—with built-in assurances of substantially reduced operating and maintenance costs!

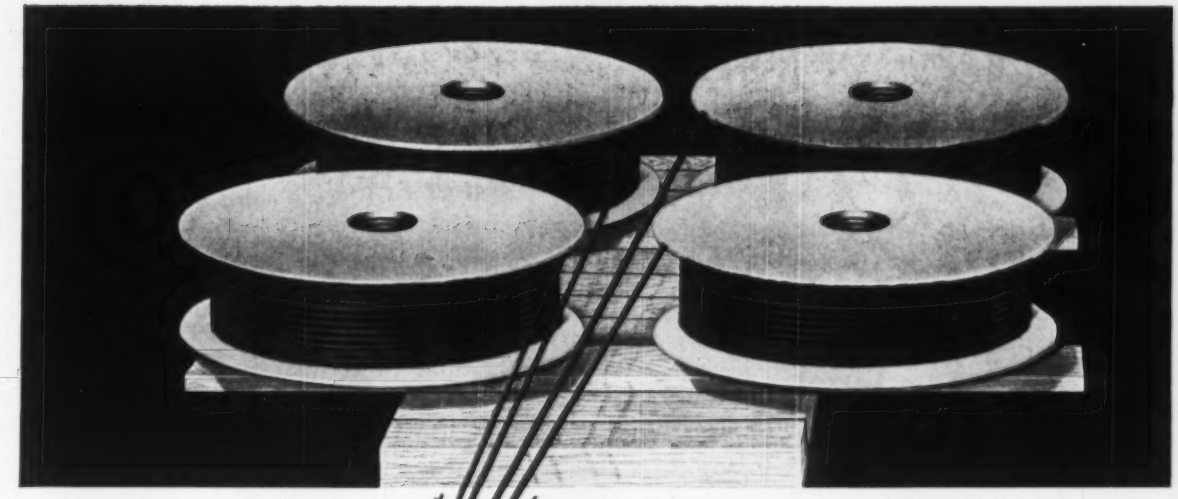
Exclusive Flooded Coolers and positive refrigerant feed control mean top efficiency over the entire range of load conditions. Automatic capacity controls save power by continuously adjusting output to prevailing load conditions. Exclusive capillary oil return assures uninterrupted oil flow under light loads! All this, in a line that has the broadest range of capacities in the industry —from 18 to 250 tons! All this, in whisper-quiet, vibration-free, lightweight units that require no special foundations or space-consuming structural supports!

For *all* the facts and figures, see your local YORK sales representative...or write York Corporation, York, Pennsylvania, for Catalog EM-213!

YORK
CORPORATION
SUBSIDIARY OF BORG-WARNER CORPORATION
IN CANADA—SHIPLEY COMPANY OF CANADA, LIMITED

Millions Live Better With YORK...
the quality name in air conditioning

Manufacturers of Residential and Commercial Heating and Cooling Systems • Air Conditioning and Refrigeration Equipment for Industrial and Commercial Installations • Room Air Conditioners • Ice Makers • Refrigeration Units and Systems



WOLVERINE LONG LENGTH COILS ARE LONG ON SAVINGS

Manufacturing refrigerators, air conditioning units or, for that matter, anything requiring copper or aluminum tubing?

If you are you can save time, money and space simply by specifying Wolverine Tube's long length bunch or level wound coils.

Level wound coils are ideal for continuous feeding of automatic equipment. (For example, the illustration in this advertisement, shows the quantity production of return bends.) Level wound coils permit high speed unwinding without the danger of the tubing becoming snarled or tangled. They often eliminate the necessity of standby operators. Both level wound and bunch coils provide greater inventory flexibility resulting in production economies as well as substantial savings in floor space requirements.

Why not get complete information about savings made possible by these Wolverine products! This advertisement attached to your letterhead will bring competent counsel from Wolverine. Mail it—TODAY!

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

CALUMET & HECLA, INC.
CALUMET DIVISION
URANIUM DIVISION
GOODMAN LUMBER DIVISION
WOLVERINE TUBE DIVISION

In Canada:
CALUMET & HECLA OF CANADA LIMITED
WOLVERINE TUBE DIVISION
CANADA VULCANIZER & EQUIPMENT CO., LTD.
UNIVERSAL TUBE DIVISION

WOLVERINE TUBE
DIVISION OF
CALUMET & HECLA, INC.
17256 Southfield Road
Allen Park, Michigan

Manufacturers of Quality Controlled Seamless and Extruded Aluminum Shapes

PLANTS IN DETROIT, MICHIGAN AND DECATUR, ALABAMA.
SALES OFFICES IN PRINCIPAL CITIES
Export Dept., 13 E. 40th St., New York 16, N. Y.

NEW DOUBLE PLATED PROTECTION!...

ONLY BULLDOG *Pitches the Grip in the RIGHT DIRECTION*

BULLDOGS bite into concrete in seconds ... Anchor Anything Permanently!

BULLDOG *Gold Digger!*

CONCRETE DRILL/ANCHORS

Here's far *more* for your concrete fastening dollar . . . *better* (double) plating with an *unmistakable* gold color finish . . . *plus* the best grip in the business.

Only Bulldog reverse-pitches the ridges to assure "the grip that never fails." Furthermore, Bulldogs are fireproof, vibration proof, safe, fast and easy to install. And *you save* the cost of special drills . . . and the time it takes to use them.

358,000 BULLDOGS USED IN BIG CANADIAN HOSPITAL

Three heliports crown St. Justine's Hospital in Montreal, one of the many big projects where Bulldog Drill/Anchors have been used.

ASK FOR NEW **Gold Digger** MANUAL

POLIS MFG. CO.
A Division of Gregory Industries
102-10 Toledo Ave.
Lorain, Ohio

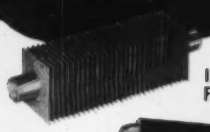
☐ Rush sample of new Bulldog Gold Digger Drill/Anchor
☐ Include new Bulldog Manual
☐ Have your Representative call

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

Products that Call for HEATING or COOLING Call for G&O

...THE GREATER-HEAT-TRANSFER, EXTENDED-SURFACE TUBING

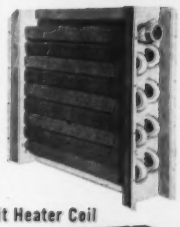
★ known for reliability since 1915 ★



Individual Fin Tubing

Square Fin, Continuous, Return Bend Coil

Square Fin, U-Bend Tubing



Unit Heater Coil

Continous Strip Fin, All-Aluminum Cooling Coil

- Tubes & Coils
- Individual finned tubing in standard sizes, square or round fins of any height or spacing
- Straight lengths, U-bends, continuous return-bend; special shapes
- Single pass, header-to-header
- Simple to install
- Free design assistance
- Write for catalog

"If it's to transfer heat, G & O can't be beat"

THE **G&O** Mfg. Co.

139 Winchester Ave.
New Haven, Conn.

1420 Ridgeway St.
Jackson, Miss.

G&O RADIATION

Can you find the Pritchard LoLine cooling tower in this picture?

Chances are it will take more than a cursory glance to spot the Pritchard LoLine Cooling Tower in the picture. That's because it is low . . . hugs the roof inconspicuously . . . becomes almost a *part* of the building. It is particularly suited for use where architectural considerations are important.

Yet the Pritchard LoLine tower is a workhorse. Its sleek appearance takes nothing away from its performance. Available in capacities of 75 tons and up, it will handle most commercial and industrial cooling requirements with ease. Initial, operating, and maintenance costs are low, too.

So whether your main concern is aesthetics or performance, air conditioning or process cooling, commercial use or industrial use, there is a Pritchard cooling tower that will fit your needs to a "T."

For full information on Pritchard LoLine Cooling Towers, send coupon for informative 16-page bulletin.

J. F. PRITCHARD & CO.
OF CALIFORNIA
Dept. 108,
4625 Roanoke Pky., Kansas City 12, Mo.

Please send Bulletin 5.1.902 on LoLine Cooling Towers

Name ..... Title .....

Firm .....

Address .....

City ..... Zone ..... State .....

Introducing the NEW MODEL 1-A SEVER-ALL Machine... CUTS AT 3 to 6 SECONDS PER SQUARE INCH—ECONOMICALLY

MANY EXTRA FEATURES AT A DELIVERED COST UNDER $500

You get the cut quality and capacity of machines nearly three times as expensive when you use the new Model 1-A SEVER-ALL oscillating dry abrasive cut-off machine. Available from your distributor's stock. Here's why the #1-A SEVER-ALL is ideal for industrial and machine shop operations:

BIG CAPACITY • Up to 2″ square solids, 3½″ O. D. pipe and tubing, 3″ angle iron, and 4″ channels . . . of cold rolled, stainless, and alloyed steel; cast iron; and nonferrous metals. Wheel oscillation, an exclusive feature in this price range, provides this *above-average* capacity.

SPEED • Cuts a 2″ x 2″ hardened steel bar in 16 seconds . . . other shapes and sizes at 3 to 6 seconds per square inch.

QUALITY • Clean, smooth cuts, even on large sections, because wheel oscillation provides cooler cutting.

ECONOMY • In addition to low initial cost, the Model 1-A SEVER-ALL is inexpensive to operate . . . occupies minimum floor space . . . requires little or no set-up time . . . eliminates annealing costs . . . gives more cuts per wheel because of oscillation.

SIMPLICITY • Just two SEVER-ALL cutting wheel specifications will do *all* your SEVER-ALL cutting jobs. A positive, screw-type vise holds all regular shapes, and an adjustable work stop provides speed and accuracy.

ANGLE CUTS • Optional accessory permits cutting angles up to 45° in either direction.

NEW SEVER-ALL AVAILABLE FROM DISTRIBUTORS

Very likely your own distributor already stocks the Model 1-A SEVER-ALL machine and wheels. If not, let us know, and we'll give you the name of your nearest SEVER-ALL distributor. Also, we'll be glad to send you complete details on this new machine. Just ask for **Bulletin DH-106.**

ALLISON-CAMPBELL DIVISION
AMERICAN CHAIN & CABLE

924-S Connecticut Avenue, Bridgeport 2, Conn.

ACCO

The family has grown!

...in size...in importance

The addition of a new and finer McDonnell 2-inch valve rounds out a line of safety relief valves for hot water space heating boilers that fulfills a vital need supremely well.

To know how true this is go back over the modern history of relief valves. With the rapid increase in closed systems, casualty companies, the National Board, and others concerned with boiler and heater safety went to work . . . and the net result was today's commendable A.S.M.E. Boiler Code calling for certified Btu-rated relief valves.

Closely following this work, McDonnell & Miller developed the first of all Btu-rated relief valves. They were not only first into the field; they are still first. They not only conform to the letter of the code; they go beyond this: *introduce new standards of their own.*

For Hot Water Space Heating Boilers

McDonnell Valve No.	Boiler Size Btu./hr.	Opening Pressure	Inlet	Outlet
230-¾ IN.-30	303,000	30 lbs.	¾"	¾"
240-¾ IN.-30	513,000	30 lbs.	¾"	1"
230-1 IN.-30	743,400	30 lbs.	1"	1"
240-1 IN.-30	910,000	30 lbs.	1"	1¼"
230-1½ IN.-30	1,025,100	30 lbs.	1½"	1½"
240-1½ IN.-30	1,560,000	30 lbs.	1½"	2"
240M-3	2,313,000	30 lbs. 36 lbs.	2"	1" 2"
240M-4	2,710,000	30 lbs. 36 lbs.	2"	1¼" 2"
240-2 IN.-30*	3,130,000	30 lbs.	2"	2½"
240-2 IN.-36*	3,550,000	36 lbs.	2"	2½"

*Recommended installation: 36 lb. opening valve, with smaller auxiliary valve set at 30 lbs. for thermal expansion.

New Bulletin P-33 gives up-to-the-minute facts

- A new bulletin shows why and how the entire rated capacity of McDonnell Relief Valves is obtained without diaphragms or other auxiliary lifting devices.
- It shows how this operation—this operation so basic to safety—is ideally accomplished by using specially calibrated "low rate" springs, matched to disc area to give smooth precise lift and tight closure.
- It explains the widely adopted McDonnell principle of progressive settings that keeps discharge in step with function . . . small valve relieving normal expansion; large stand-by valve ready for the emergency.

These and many more significant facts are covered in the bulletin. Note the accompanying table listing a valve for practically every boiler—McDonnell quality straight across the board.

Coupon brings your copy

McDONNELL & MILLER, Inc.
3500 N. Spaulding Ave., Chicago 18, Ill.
Doing One Thing Well

Your Jobber Stocks Them

McDONNELL

Safety Relief Valves

Boiler Water Feeders • Low Water Fuel Cut-offs • Pump Controllers • Flow Switches • Related Liquid Level Controls for Tanks, Stills, Air Conditioning Systems

Send me a copy of new Bulletin P-33 covering McDonnell Safety Relief Valves for hot water space heating boilers.

COMPANY NAME _____

STREET ADDRESS _____

CITY, ZONE & STATE _____

BY _____

Mail to: McDonnell & Miller Inc., 3500 N. Spaulding Ave., Chicago 18, Ill.

UNION
CARBIDE
Ucon
BRAND
refrigerants

Coming soon...

Ucon BRAND refrigerants

Important News For the Refrigeration and Air Conditioning Industries...

UCON Refrigerants will be dry, pure, top quality

With UCON Refrigerants you will get quality that meets the highest industry standards. And you can choose from five grades, UCON 11-12-22-113-114.

But you'll get more. Much more.

Personal Service from technically trained representatives. The UCON Refrigerants service force is the largest in the United States.

Full Choice of Unit Sizes to meet your needs. UCON Refrigerants will be available in 10, 25, 145 lb., or ton cylinders; truck-tank or tank-car quantities.

Prompt Delivery from the largest network of distribution points serving America's refrigeration and air conditioning industries.

America's newest fluorocarbon plant will bring you a UCON Refrigerant for your air conditioning and refrigeration application. And there are new, exciting developments, soon to come. For full data write UCON Refrigerants, Union Carbide Chemicals Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, New York.

"Ucon" and "Union Carbide" are registered trade marks of Union Carbide Corporation.

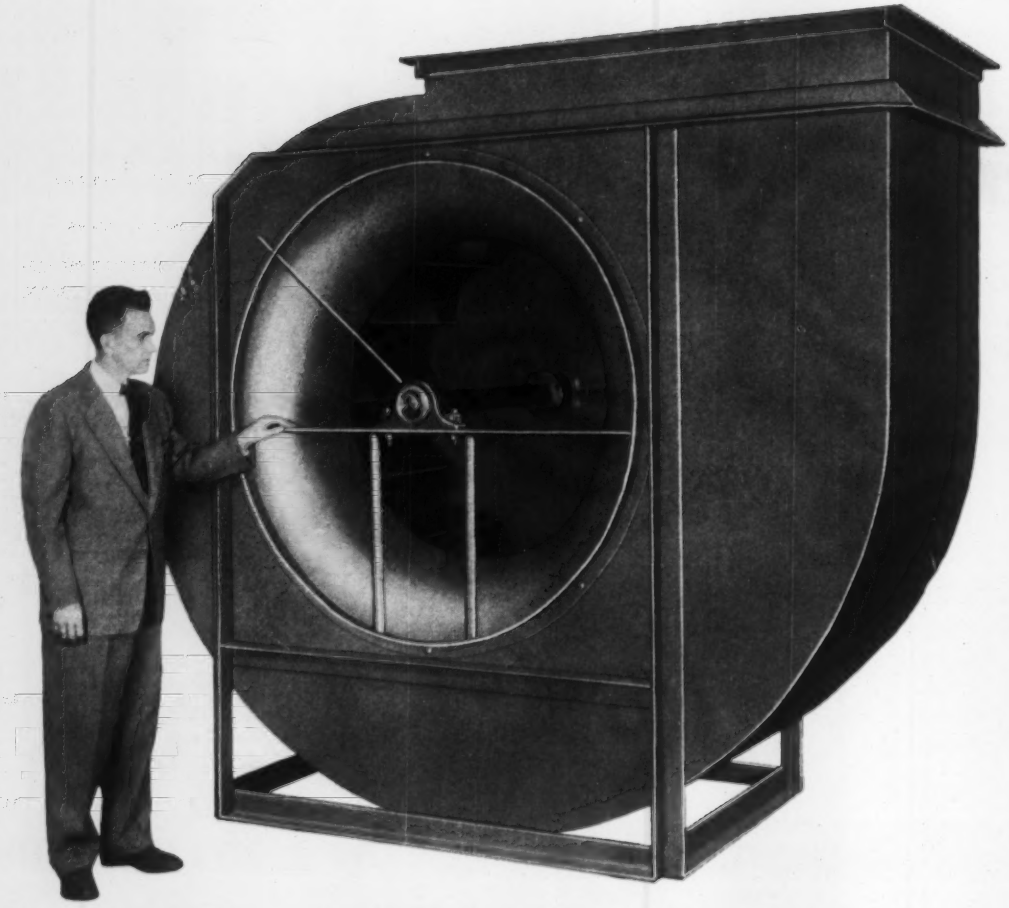
UNION CARBIDE

Ucon BRAND refrigerants

These 5 UCON Brand Refrigerants will meet your refrigeration and air conditioning needs

UCON Refrigerant 11 Trichloromonofluoromethane
UCON Refrigerant 12 Dichlorodifluoromethane
UCON Refrigerant 22 Monochlorodifluoromethane
UCON Refrigerant 113 Trichlorotrifluoroethane
UCON Refrigerant 114 Dichlorotetrafluoroethane

UNION CARBIDE CHEMICALS COMPANY *Division of Union Carbide Corporation*



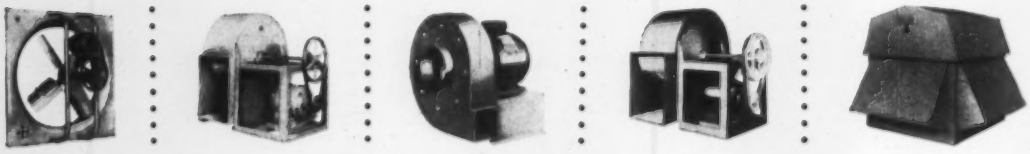
BIG BLOWERS ARE BIG BUSINESS WITH PEERLESS

QUIET! • TROUBLE-FREE! • DEPENDABLE! • HEAVY DUTY! • GUARANTEED!

Versatility in size, application, and engineering has always been a Peerless strong point. Peerless builds its own motors and matches them to the specified blower requirements. Peerless blower frames and housings are usually heavier than any competitive products. Result—a quiet, vibration-free unit.

These are not "off-the-shelf" units, but built to customer rotation and discharge specifications. Each one receives 100% inspection before it leaves the Peerless factory. Each unit is built to NAFM standards. Motors are built to NEMA standards. Each unit is ready for operation when received at the installation site.

A COMPLETE LINE OF AIR MOVING EQUIPMENT



See our Catalog in Sweets

Charter Member of the Air Moving and Conditioning Association, Inc. (AMCA)

Peerless Electric

FAN AND BLOWER DIVISION

THE Peerless Electric® COMPANY

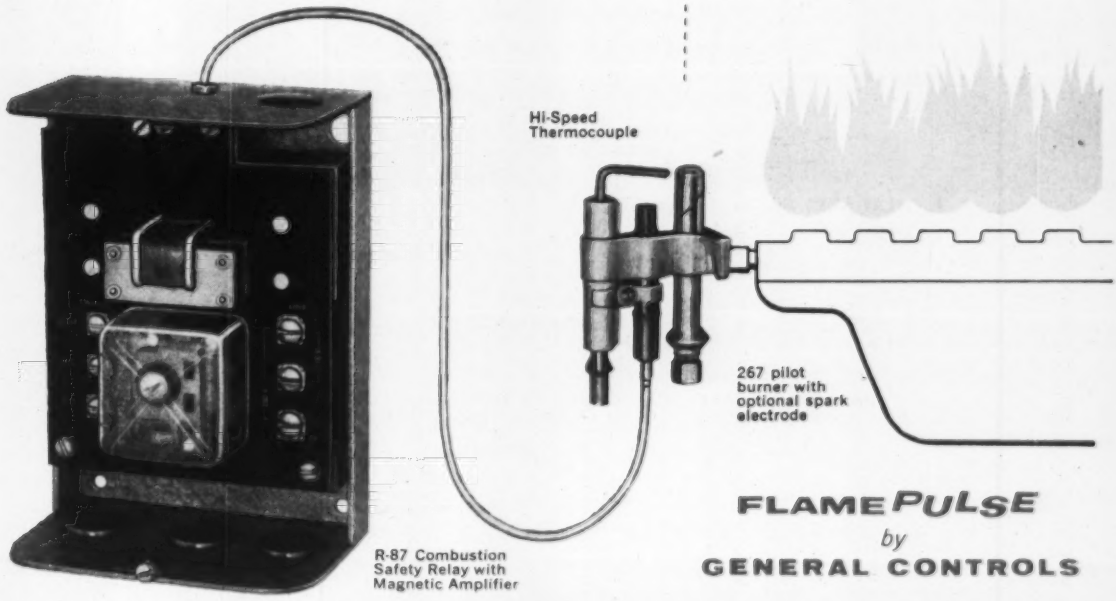
1409 W. MARKET ST. • WARREN, OHIO

FANS · BLOWERS · ELECTRIC MOTORS · ELECTRONIC EQUIPMENT

Write Today for Bulletins SDA-220, SDA-200 and SDA-160.

NEW HIGH SPEED THERMOCOUPLE GIVES 5-SECOND SHUTDOWN!

a whole new concept in FLAME SAFETY for medium-size gas burners


Hi-Speed Thermocouple
267 pilot burner with optional spark electrode
R-87 Combustion Safety Relay with Magnetic Amplifier

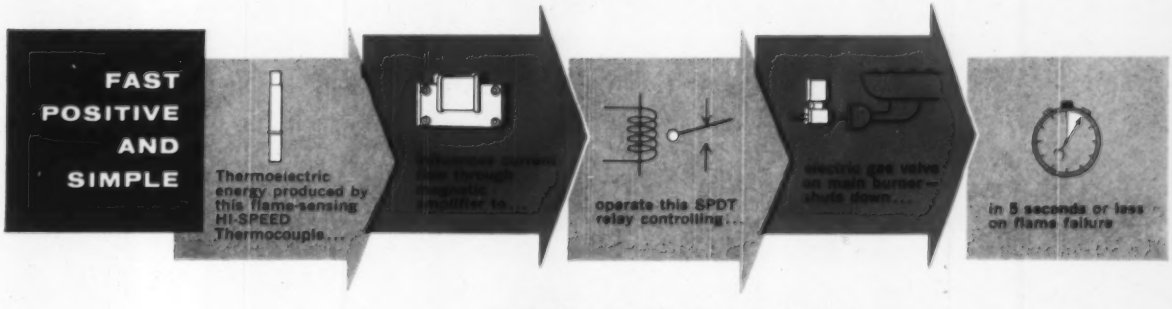
FLAMEPULSE
by
GENERAL CONTROLS

CHECK THESE FEATURES:

- no tubes to replace
- no warm-up period
- no moving parts
- shock-proof...damage-proof
- no chance to fail unsafe

This new combustion safety relay has been put to every conceivable field test for over 3 years... with remarkable results. It employs two proved principles for positive operation: *reliable magnetic amplification* and *time-proved thermoelectric energy*. Flame-sensing HI-SPEED thermocouple responds to flame failure in 5 seconds or less. Simple construction...uncomplicated installation... simplified maintenance...speed...surety...*all* make the new General Controls R-87 FLAMEPULSE more reliable, lower in cost and upkeep. It's the *low-cost* answer to safety control for medium size burners in warm air, hot water and steam-heating, cooking and processing equipment in sizes to 2-million BTUs.

Magnetic amplifier input voltage: 24,115 or 230V 60 cy AC; SPDT Relay Switch Rating: 3 amps @ 24V AC; 1.5 amps @ 115V AC; .75 amps @ 230V AC. Companion Pilot Burner: No. 267: 1800 BTU for all gases. With spark electrode and additional generator cartridge.


FAST POSITIVE AND SIMPLE
Thermoelectric energy produced by this flame-sensing HI-SPEED Thermocouple...
operate this SPDT relay controlling...
in 5 seconds or less on flame failure

TEST SAMPLE—Commercial burner and boiler manufacturers: Ask your nearby General Controls office for sample to test with your own equipment.

another advance from...

GENERAL CONTROLS

Manufacturers of America's Finest Automatic Controls for Home, Industry and the Military

Glendale, Calif. • Skokie, Ill. • Guelph, Ontario, Canada

Six Plants—42 factory branch offices serving the United States and Canada

TEVA*...best way to compare pipe insulations

Recently a company building a new plant asked us questions about Snap*On, the one-piece pipe insulation of fine glass fibers that simply snaps on pipe. How would 1½" thick Snap*On compare thermally with 2" of another insulation? What effect would it have on material costs? . . . on operating costs?

Our answers were contained in the following TEVA* report:

*Thermo-Economic Value Analysis

PURPOSE . . . to compare Snap*On with Insulation "A".

BASIS OF COMPARISON . . . 15,000 lin. ft. of 8" (average size) pipe
Average Pipe Temperature—350° F
Annual Operating Time—7200 hrs.
Cost of Heat—$0.50/million Btu
Heat Loss Values—Published by manufacturers

CONCLUSIONS

A. HEAT LOSS (Btu/Lin. Ft./Hr.)

Insulation "A", 2" thick	132
SNAP*ON Pipe Insulation, 1½" thick	98
SNAP*ON Savings (Btu/Lin. Ft./Hr.)	34

B. ANNUAL SAVINGS—$ OPERATING COSTS

15,000' x 34 Btu x 7200 Hrs. = 3,672,000,000 Btu
$0.50 (per million Btu) x 3.672 = Annual Saving of $1,836

C. INITIAL SAVINGS—MATERIAL COST

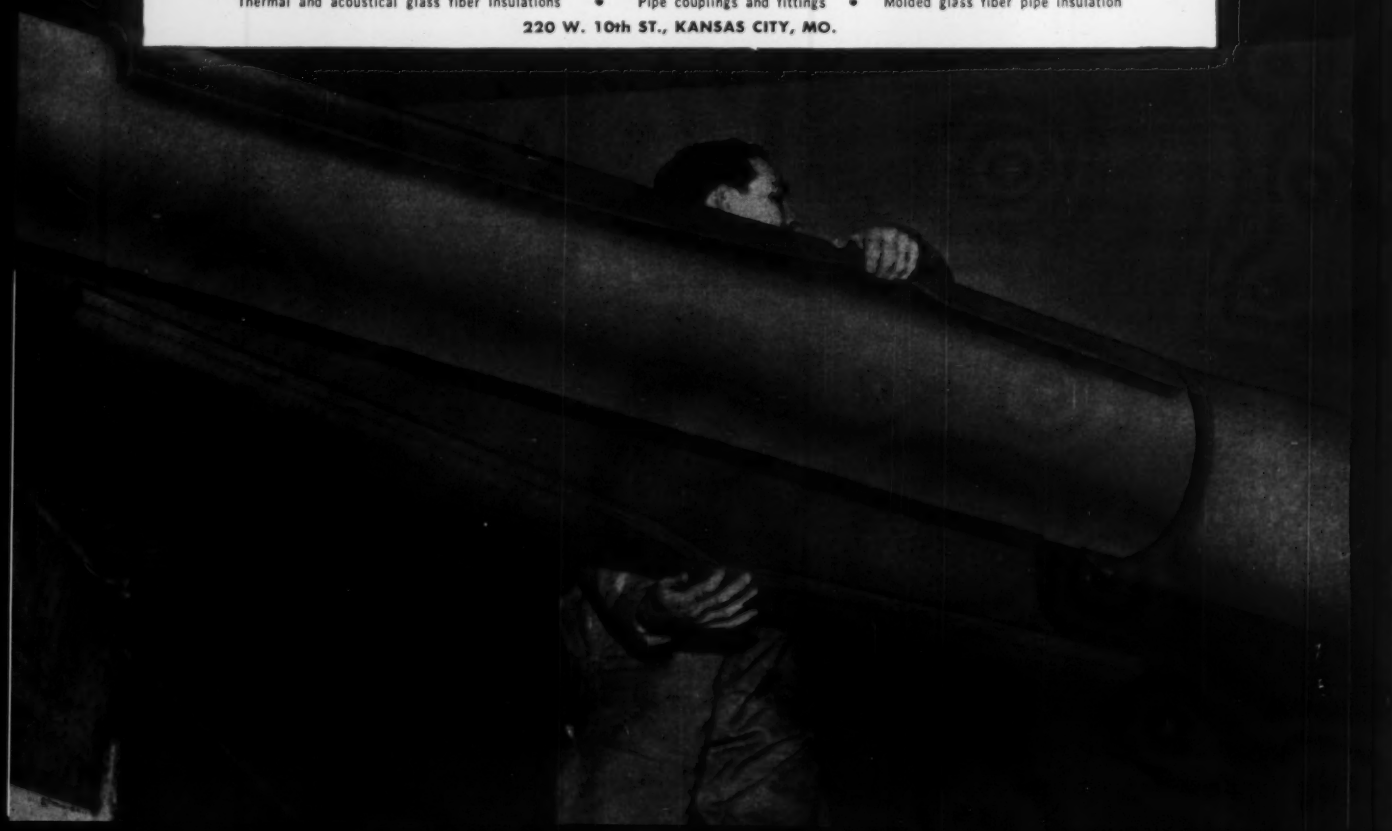
2" Insulation "A", 15,000 lin. ft. @ $2.08	$31,200
1½" SNAP*ON, 15,000 lin. ft. @ 1.404	21,060
MATERIAL COST SAVINGS WITH SNAP*ON	$10,140

*TEVA (THERMO-ECONOMIC VALUE ANALYSIS) IS AN EXCLUSIVE G-B SERVICE. NO OBLIGATION — JUST CALL YOUR LOCAL G-B DISTRIBUTOR

GUSTIN-BACON *Manufacturing Company* GUSTIN gb BACON

Thermal and acoustical glass fiber insulations • Pipe couplings and fittings • Molded glass fiber pipe insulation

220 W. 10th ST., KANSAS CITY, MO.



2 Broadway

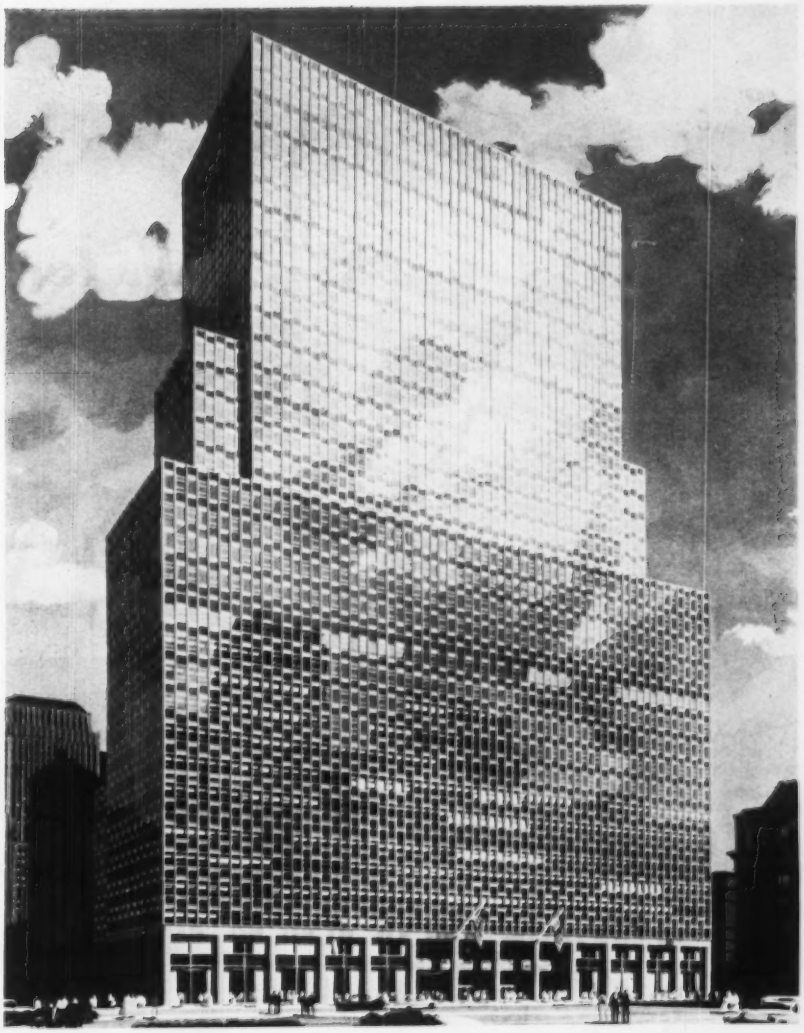
ANOTHER MODERN

"NEW YORK LANDMARK"

Equipped with

Yula

HEAT EXCHANGERS



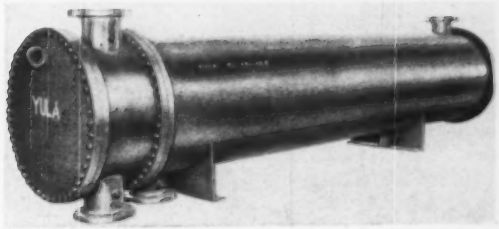
Architects—EMERY ROTH & SONS

Consulting Mechanical Engineer—R. L. STINARD and H. B. OEHRIG

Mechanical Contractor—RAISLER CORP.

Owners and Builders—URIS BROTHERS INC.

The Interchanger shown at the right is one of seven furnished by YULA at the 2 BROADWAY BUILDING. Each zone is serviced with an Interchanger in conjunction with a Secondary Hot Water Convertor to supply both hot and cold water for the periphery induction units, affording year-round air conditioning comfort. YULA "tailor-made" the exchangers with nozzle connections located conveniently to greatly simplify piping hook-up and allow rapid installation.



Yula

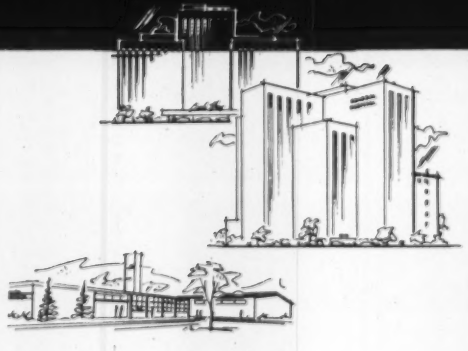
HEAT-TRANSFER EQUIPMENT

YULA WATER HEATERS, INC. 330 BRYANT AVE., NEW YORK 59, N. Y.

your job* calls for the best and...

in Fire Protection Equipment there's only one best:

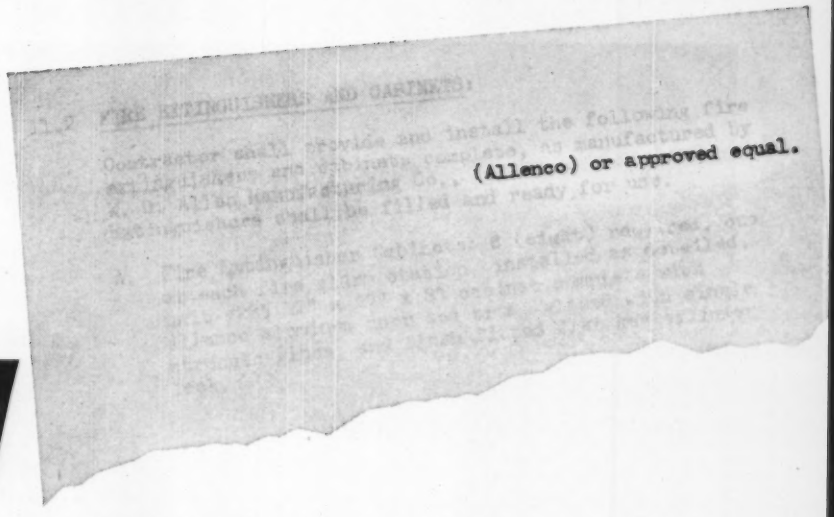
ALLENCO



**Commercial and Public Buildings, Hotels, Hospitals, Schools, Churches, Multi-Unit Residential Buildings*

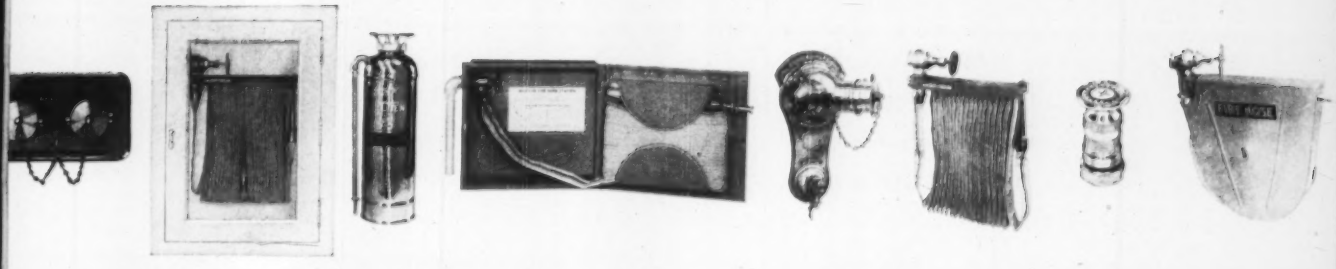
See why **ALLENCO** leads year-in and year-out . . .

- Ask architects, engineers, contractors or fire authorities
- Check Sweet's or Domestic Engineering catalog directory
- Write for your own copy of Catalog 150—A.I.A. file 29e2



best for *specifying

- Wide selection to meet *any* requirement of code or insurance, structure or design, owner's operation or budget
- Detailed data *and* ready-to-copy standard specs in catalog form and also from nearby, reliable Fieldmen
- Best known *name*, thoroughly backed by manufacturer



best for *installing

- No delays: prompt quotes; accurate rough-in data; delivery on time *and* as specified
- Lower costs: competitively priced; goes in faster, needs no more work
- Reliable: on-the-job help as needed; lasting good looks and service

*Write for catalog, or phone your **Allenconsultant** listed in Yellow Pages.

SINCE 1889

W. D. ALLEN MANUFACTURING CO.

ROOM 500, ALLENCO BLDG., 566 W. LAKE ST., CHICAGO 6, ILL.

"This sheet has just the right stiffness and ductility"

He's talking about a sheet of Bethcon galvanized steel, and his enthusiasm is shared by an ever-growing number of sheet-metal workers.

Bethcon has that very desirable combination of stiffness and ductility because of Bethlehem's up-to-the-minute continuous galvanizing lines, which include a continuous annealing process. This treatment turns out sheets which are easy to work into a strong, rigid sheet-metal product.

Bethlehem's continuous galvanizing process bonds the zinc to the steel so tightly that it virtually eliminates peeling or cracking of the coating. Even when you double the sheet back on itself, the zinc stays put. The coating is uniform, too, both in appearance and in thickness. Since a Bethcon sheet has no drip end, it has no bothersome bead.

You can order Bethcon in 13-gage and lighter, in either plain open-hearth or copper-bearing steel. A Bethlehem representative will gladly call to discuss your sheet-metal operations with you, and to give additional information about Bethcon. Just call or write to the Bethlehem sales office nearest you, or write to the address below.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation.

BETHLEHEM STEEL

New information for engineers about the lowest-cost air conditioning of all . . .

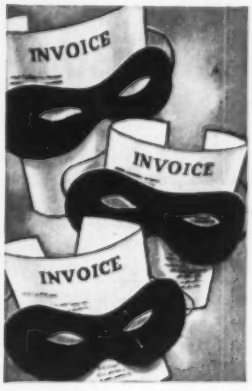
How CHRYSLER'S AIRTEMP controls

The 3 "Secret Costs" of Air Conditioning

"Secret Costs" can quickly amount to more than original cost...

But, when you specify AIRTEMP, you control "secret costs"

And you give your clients a brand they know—and trust.



No matter what kind or size of installation your plans call for, Chrysler AIRTEMP makes it . . . and you pay no more for it.

But the important fact is this: Chrysler AIRTEMP costs your client *far less* in the long run because it minimizes the 3 "secret costs" of air conditioning. And these may be more important than the first cost!

THE SECRET COST OF WRONG EQUIPMENT
The wrong equipment can be troublesome as well as costly to operate. Airtemp makes all kinds of air conditioners—over 297 models—and can advise you on which is best for your client's needs. You're sure to get exactly the right equipment from Airtemp!

THE SECRET COST OF OPERATION
Operating costs over a few years may actually exceed the first cost of air conditioning. But rock-bottom operating costs can save substantial sums. That's why you should know that AIRTEMP—thanks to Chrysler engineering—promises the lowest operating costs in the industry!

THE SECRET COST OF MAINTENANCE
Maintenance costs and repair costs can be a shock. A breakdown brings repair bills PLUS the cost of lost time, lost business. But Airtemp air conditioning is carefully engineered by Chrysler for trouble-proof operation. And Airtemp is installed only by qualified contractors, who must certify to Airtemp that equipment, warranted for 5 years, has been installed properly. That's why Airtemp maintenance costs average out to be the lowest in the industry!

May we give you the complete facts—including data about Airtemp's new lease-purchase plan that saves you money on taxes, conserves working capital. For prompt action mail the coupon below. Or phone your nearest Airtemp contractor or dealer who is listed in the Yellow Pages.

CHRYSLER

Airtemp

AIRTEMP DIVISION, CHRYSLER CORPORATION
Dept. HP-9-58, Dayton 1, Ohio
We would like the full facts on how Airtemp controls the 3 "secret costs" of air conditioning.

Name_____
Address_____
City_____ Zone____ State_____
Firm Name_____

Bishop Clarkson Memorial Hospital — Omaha, Nebraska

Leo A. Daly Company
architect-engineer

Peter Kiewit Sons Co.
general contractor

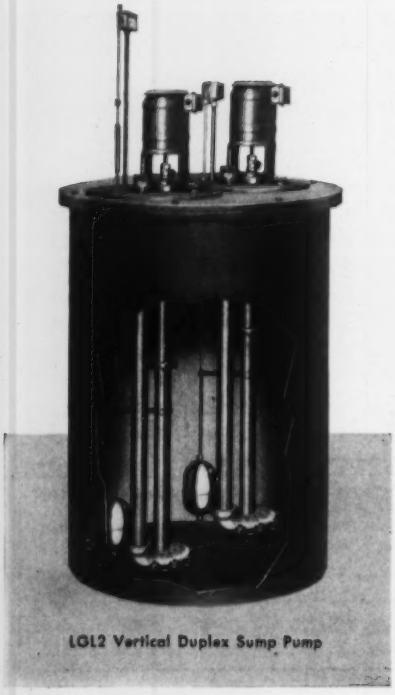
Natkin & Company
plumbing contractor

"Chicago" Vertical Duplex Sump Pumps Protect Bishop Clarkson Memorial Hospital

Quiet Operating . . . Low Cost . . . Dependable

"Chicago" Type LGL2 Vertical Duplex Sump Pumps are ready to provide instantaneous and lasting protection against flooding of vital mechanical equipment at the Bishop Clarkson Memorial Hospital . . . winner of The Modern Hospital Honor Award in 1955.

These pumps include a mechanical alternator to automatically transfer operation from one pump to the other, equalizing wear and allowing both pumps to operate when inflow to the basin exceeds the capacity of one pump.



LGL2 Vertical Duplex Sump Pump

IMPORTANT MECHANICAL FEATURES:

- Oilless guide bearings requiring no lubrication.
- Cast iron strainers
- Efficient bronze impellers
- Grease lubricated ball thrust bearings

49 years of engineering and manufacturing experience are incorporated in all Chicago Sump Pumps to insure highest quality . . . trouble-free service.

Architects and Engineers are invited to write direct or contact Chicago Pump Company Distributors located in most principal cities for bulletins and complete engineering data.

Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION

Chicago Pump Company

622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Copyright 1958—Chicago Pump Company

pioneer producer shows the way to lower cost silencing!

THESE 3 PRODUCTION SIZES SAVE 20%!

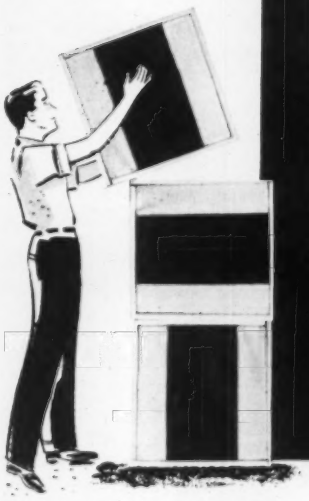
Full Size	Half Size	Quarter Size
24" x 24" x 30"	12" x 24" x 30"	12" x 12" x 30"

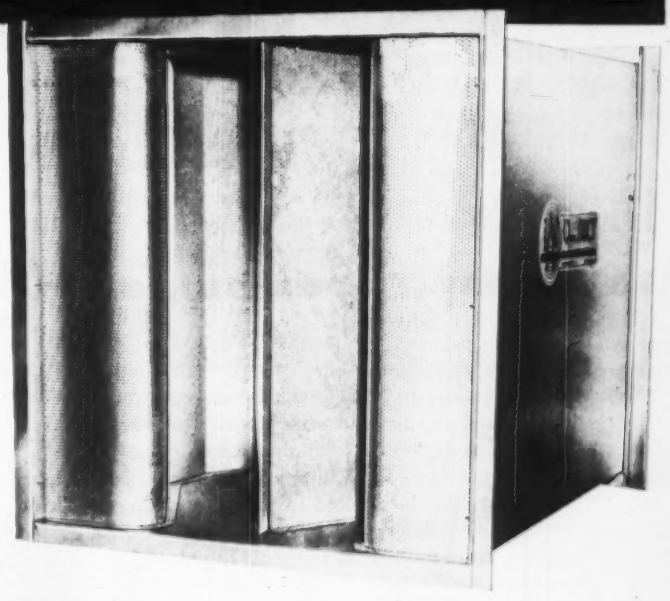
MOD-Size

Trade Mark

Quiet-DUCT Silencers

- ✻ STOCK SHIPMENT
- ✻ GUARANTEED SILENCING
- ✻ LOWER HANDLING COSTS





MOD-Size Quiet-DUCT Silencers provide low cost, guaranteed silencing — now made possible by production-line volume!

MOD-Size Quiet-DUCT Silencers cost 20% less than the other silencers!

MOD-Size Quiet-DUCT Silencers achieve further economies by reducing handling and installation costs. They can easily be "built-up" in parallel or in series to meet any capacity and/or acoustic requirement!

MOD-Size Quiet-DUCT Silencers are certified for air flow and pressure drop — as well as acoustic performance — by tests from recognized, independent laboratories!

IAC — Your Standard of Silence

Air Conditioning Department
INDUSTRIAL ACOUSTICS COMPANY, INC.
341 Jackson Avenue, New York 54, N.Y.
CYpress 2-0180
"Specialists in Noise and Pulsation Control"

Air Conditioning Department
Industrial Acoustics Co., Inc.
341 Jackson Avenue
New York 54, N. Y.

☐ Send details on "Mod-U-Size" Quiet-DUCT Silencers
☐ Have representative call.

Name _____ Title _____
Company _____
Address _____
City _____ Zone _____ State _____

B&W's Mr. Tubes helps you engineer for profit

When your application involves steel tubular products, B&W's Mr. Tubes can help you *engineer for profit*—help you reduce costs and make a better product. Here is the reason why you should make him a member of your product-planning team:

Mr. Tubes, your local B&W district salesman—is thoroughly qualified to help you select the *one* tubular product best suited to your fabricating operations and end-use applications. For instance—in the case of a heat exchanger—should the tubing be seamless or welded? Single length or center welded for unusually long length? What about tolerances? Grade of steel? Mechanical properties and heat treatment? Standard or special specifications?

These are but a few of the many factors involved in determining the right tube for a job. Next time you are planning a product in which tubing is used — call in Mr. Tubes. He can be a valuable member of your team. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

B&W
TUBULAR PRODUCTS DIVISION

TA-3033-G6

Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges —in carbon, alloy and stainless steels and special metals.

WITH MODERN process and power piping applications demanding ever higher temperature and pressure operating conditions, the need for piping technologies to keep up with this rapid pace is critical. A big step in meeting this need is the development of an advanced approach to piping flexibility analysis. *See page 130.*

A new high school's architecture made the design of its heating system a real puzzler. The answer: various methods of heating to suit different areas. *See page 134.*

Sweden's newest and largest air raid shelter—in rock, 100 ft below the surface—features a ventilation system designed for atomic war emergency. *See page 136.*

June Building Contracts Continue May's Surge

. . . but nonresidential building lags

CONSTRUCTION CONTRACTS in the U.S. in June totaled more than $3.8 billion, by far the highest figure ever reported for any single month, according to F. W. Dodge Corp.

The June contracts were 12 percent above the previous high record which had been established only a month earlier, and were 18 percent higher than in June of last year.

According to Dodge vice president and economist Dr. George Cline Smith, the gains were general through all types of construction, with only a few exceptions.

"When signs of an upturn in construction contracts first appeared in April," Dr. Smith stated, "we reported that the recovery seemed to have a broad, solid base. This fact has been more than confirmed in May and June, with the dollar figures exceeding all expectations.

"A number of very large utility contracts, particularly in connection with the St. Lawrence Seaway, helped boost the June total," he said, "but the most encouraging feature was perhaps the big increase in housing activity across the nation.

"The effect of government programs was particularly noticeable in June, since public ownership contracts were 30 percent ahead of the same month of last year. Nevertheless, privately owned projects also rose by a substantial 11 percent. Regardless of ownership, the net effect of this upsurge in the nation's largest industry is bound to be a big boost to the rest of the economy, which will be felt for many months to come as work proceeds on the projects now under contract," added Dr. Smith.

The sole dissenter among the major construction contracts was nonresidential building. In June, these were valued at $976,044,000, down 18 percent from the same month last year. Within this category, sharp declines were registered for manufacturing buildings (down 67 percent) and commercial buildings (down 27 percent). Educational building contracts dropped 3 percent below a year ago. Public buildings, religious buildings, hospitals, and recreational buildings all showed gains over the comparable year-earlier levels.

Contracts for residential buildings were valued at $1,364,231,000, a gain of 20 percent over a year ago. Large apartment buildings showed the largest percentage increase—69 percent. Houses also rose sharply to 17 percent ahead of last year. The number of dwelling units represented by the June contracts totaled 107,014, up 24 percent from June 1957.

Heavy engineering contracts in June amounted to $1,479,307,000, a gain of 64 percent over the same month last year. Public works contracts were up 22 percent and utilities contracts were 225 percent higher than a year ago. Street and highway contracts in June rose 45 percent above the year-earlier level. Contracts for electric light and power systems were up 479 percent. Pipelines also registered substantial gains.

The cumulative total of contracts for future construction in the first six months of 1958 amounted to $16,788,625,000, down 1 percent from the comparable 1957 period. Cumulative totals by the major categories showed: nonresidential, at $5,507,862,000, down 8 percent; residential, at $6,504,707,000, up 1 percent; and heavy engineering, at $4,776,056,000, up 6 percent. ⊣

GIVE

THE UNITED WAY

to: UNITED FUNDS
COMMUNITY CHESTS

Construction Cost Index 2nd Quarter Up 6 Points

. . . increased material, labor costs

THE CONSTRUCTION COST INDEX (national average) rose 6 points during the second quarter of 1958, as compared to 10 points for the same period in 1957, the American Appraisal Co. reports.

This increase was caused by scattered material price increases and higher labor rates which became effective during this period.

The index is based upon a detailed analysis of materials and labor required for representative types of industrial building structures, repriced monthly in accordance with (1) prevailing wage scales and labor per-

formance for the various building trades, and (2) quotations for construction materials in 30 key cities in the U.S. ∓

Gas Industry Sales Ahead Of Slack Industrial Pace

. . . up 4.3 percent in May

IN MARKED CONTRAST to the nation's industrial production pace, the gas utility and pipeline industry registered a substantial gain in industrial sales during May, the American Gas Association reports.

Industrial production in May, as measured by the Federal Reserve Board index, was down 11.8 percent compared with May 1957. Industrial gas sales, however, climbed 4.3 percent to 3404 million therms against 3264 million therms for the same month a year ago.

Total gas sales to ultimate consumers totaled to 5823 million therms in May, a gain of 1.5 percent on a year-to-year basis, with natural gas accounting for more than 97 percent —5653 million therms.

For the year ending May 31, total sales were 79,256 million therms, an increase of 6.8 percent over the 74,190 million therms sold in the previous 12 month period. ∓

World's Fair 'Real Cool' For Tourists, Displays

. . . added U.S. contribution at Brussels

HOT DOGS and hot jazz are two typically American contributions to the Brussels World's Fair. But there's a cool side to the story, too — air conditioning.

And keeping cool is more important to several tons of chocolate figures in the Belgian Gold Coast exhibit than it is to Benny Goodman's cool cats, according to Minneapolis-Honeywell Regulator Co.'s engineers, who helped design the control system for the major part of the air conditioned buildings at the exposition.

The air conditioning system is designed to keep the artistic figures and animals — made of chocolate and described by officials at the fair as the finest in the world — from becoming a gooey mess halfway through the 180 day fair.

Air conditioning is equally important to the Belgian Congo's exhibit of stuffed animals. The system — in which two air conditioners remove 280,000 Btu — also filters dust from the air which would ruin the skins of the stuffed beasts.

Toughest control problem was designing a system for the Atomium, one of the major attractions for the 35 million persons expected to visit the fair. The Atomium is designed in the shape of the structure of an atom and represents a 360 ft maze of aluminum tubes and balls.

With approximately 100,000 persons expected to visit this futuristic structure each day, a means had to be found to air condition the Atomium to provide comfort on the hot days common in Brussels.

The unusual design of the Atomium made it impossible to use a chimney. Hence, it was necessary to use electricity of all six Atomium balls for heating and also to provide each with a separate air conditioning system to enable each sphere to meet any solar radiation problems it might encounter.

To get an idea of what was required to handle the job, the bottom sphere and elevator lobby (which receives the heaviest traffic) uses 170,000 calories per hr.

There also was a nature-made obstacle. The site is on sand, so the engineers had to look elsewhere for cold water for the air conditioning system. The source of the water is a stream, barely a block from the Atomium, that flows across the exposition grounds in the form of a gentle waterfall. Part of this surface water is illuminated at night to add beauty to the area.

The only pavilions requiring zoning were the Czech and U.S. pavilions. In both cases, the pavilions were zoned into three parts — theater, restaurant, and exhibition hall.

The American pavilion is unique in that air conditioning consultation was done in Washington rather than on the construction site. Compressors were imported, with the manufacturer's Belgian subsidiary handling the installation and ductwork. ∓

MCAA Study Committee Lays Merger Groundwork

. . . meets with local groups

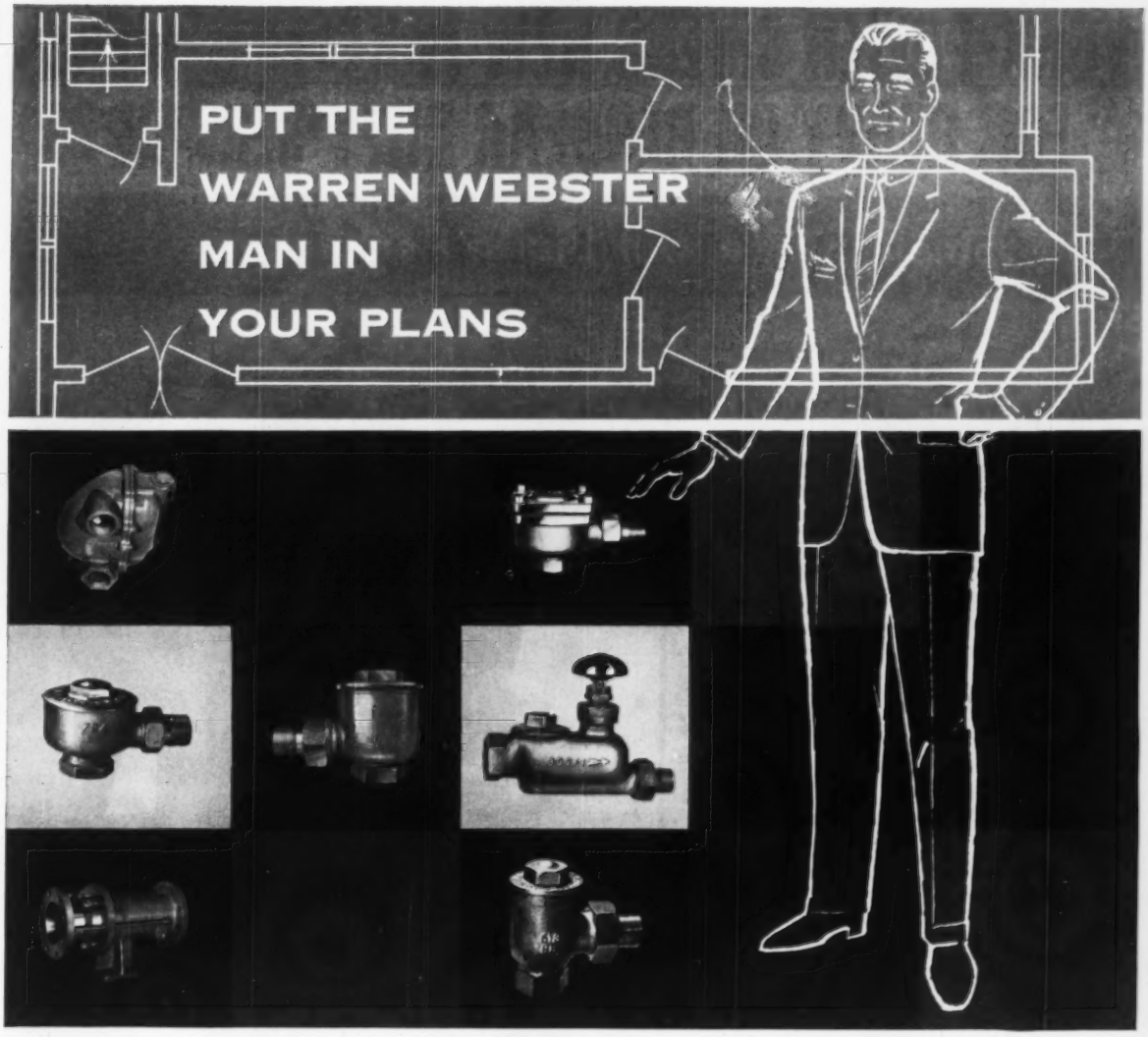
PRELIMINARY PLANNING for future meetings of the MCAA-NAPC merger study committee took place recently in New York when the five man committee of the Mechanical Contractors Association of America met with representatives of six local associations.

Joseph H. Spitzley, chairman of the committee, indicated that the meeting was held in accordance with the resolution passed by the 69th annual convention of MCAA that empowered the board of directors to establish a committee to meet with a like committee of the National Association of Plumbing Contractors to study the possibilities of a merger of the two associations on mutually desirable terms.

The resolution, as passed by the convention, further required that, prior to the first meeting with NAPC, the merger study committee meet with an advisory committee consisting of representatives of affiliated local associations desiring representation on the advisory committee. ∓

"Quote"

"The principle of any mechanical, electrical, or structural item has existed since the beginning of time. The realization of a principle dawns in the imaginative mind of the inventor. The usage of the principle is the invention."—*B. F. Rose, Jr., manager, architect-engineer division, Aerojet-General Corp., speaking at the 69th annual convention of the Mechanical Contractors Association of America in Los Angeles recently.*



Ask Any Heating Man . . . And You'll Specify "Webster Traps"

Your Warren Webster Man knows traps . . . and any heating man knows the reputation for quality, performance and economy that's built into every Webster Trap.

Webster — the company that made the *first* thermostatic trap — makes a *complete* family of traps to meet every plant engineering need. Heavy-duty, lightweight, trouble-free Webster Series 27 Drip Traps in five sizes . . . thermostatic traps . . . process steam traps . . . dirt strainers — in fact, every steam specialty you need for uninterrupted dependability and low-cost, over-the-years operation.

For 70 years, Webster has made and sold Webster Traps. And today, the Webster line is still the industry's standard. Ask any heating man! Then talk it over with your Warren Webster Man. Or write for our Condensed General Catalog, Bulletin B-151. Warren Webster & Company, Camden 5, New Jersey. Since 1888. Offices in principal U.S. cities and Canada.

WEBSTER'S
FINEST
PRODUCT

the Warren Webster Man

WARREN WEBSTER

HEATING . . . COOLING

YORK-POWER OFFERS NEW PAKETTE BOILERS FOR HEAVY OR REGULAR DUTY SERVICE

Small in Size, but Big in Performance

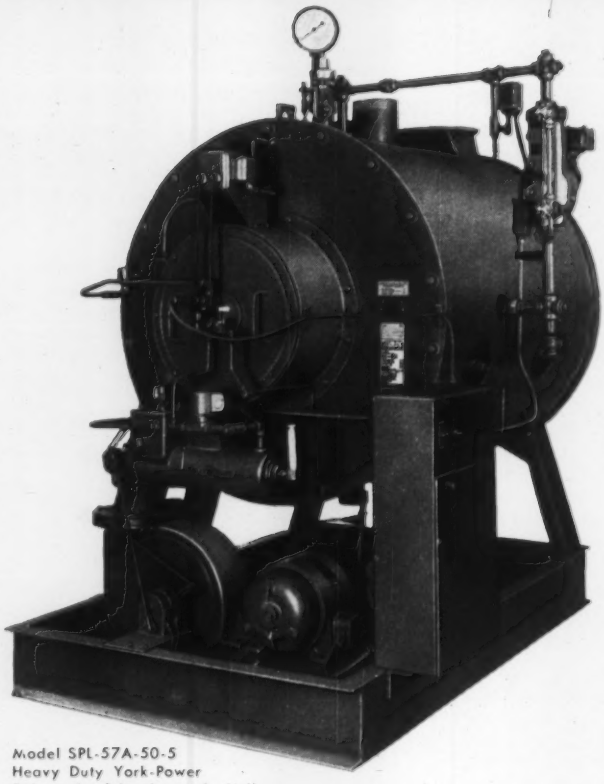
York-Power Pakettes—compact packaged boilers in sizes from 10 hp. up—offer all of the features of the large Steam-Pak automatic boilers for which York-Power is justly famous. Now York-Power offers two diversified lines of Pakettes—heavy duty and regular duty—for high or low pressure steam or hot water.

Heavy Duty Pakettes features a wet-back head and divided baffle arch—features that provide long life and extremely low fuel and maintenance costs.

Regular Duty Pakettes fit most applications where high operating efficiency and low cost operation with automatic boiler are required.

All Pakettes are available for firing heavy or light oil and combination fuels. They offer savings on maintenance, breeching, chimney, installation costs and on wiring.

York-Power Pakettes are ideally suited both for cost and space saving for dairies, heating plants, laundries, bottling, dry cleaners, and industries where quantities of steam and hot water at proper pressures and exact temperatures are required.



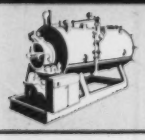
Model SPL-57A-50-5
Heavy Duty York-Power
Pakette for firing heavy fuel oil.

Check over these York-Power Pakette MONEY-SAVING FEATURES

- Compact design saves floor space.
- Fully wired electronic safety controls assure positive, safe, economical operation.
- Exclusive Iris Shutter provides perfect metering of air.
- Built-in forced draft, eliminates costly stack.
- Viscosity compensator with heated metering ports assures perfect heavy-oil circulation.
- "Swing away" rear door for quick easy cleaning.

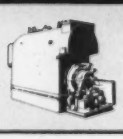
York-Power Pakettes are sold through Supply Houses. A few choice distributorships are still open.

Industrial Division **YORK-SHIPLEY, Inc.** YORK, PA.



STEAM-PAK
15 to 600 Hp.
Oil and/or Gas Firing

PAKETTE
10 to 50 Hp.
Oil and/or Gas Firing



FIRE-PAK
35 to 485 Hp.
Oil and/or Gas Firing

SCOT-PAK
52 to 400 Hp.
Oil and/or Gas Firing

Industrial Division York-Shipley, Inc. York, Pa.

.....Please send me your new illustrated brochure showing the new York-Power Pakette line.

.....Have your representative call and give us further information.

Name .....

Company .....

Address .....

City..... Zone..... State.....

"Open for Discussion"

• *WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

Stronger Emphasis Should Be Placed On Need for Mechanical Exhaust

GENERALLY SPEAKING, the article, *Industrial Ventilation: How Is It Designed?*, by John H. Clarke (June), is well written and covers this important subject quite well.

However, I personally believe that stronger emphasis should be placed on the need for mechanical exhaust. Certainly a system designed especially for an industrial plant of any magnitude can be engineered to include the proper air changes, placement of exhaust fans, and makeup air units. Thus, the building will be under control, and will not be dependent upon wind direction, velocity, nor natural thermal convection. The advantages of this type of system far outweigh the cost disadvantages.

Making up air in a building can present a major problem, and, is costly. However, there are many cases where unheated makeup air can be introduced into an area requiring abnormal exhaust requirements without discomfort to personnel.

Along this same vein, and as pointed out in the article, wall type heating coils are effectively used in some cases. The motive force through the coil is provided by the exhaust system creating a negative pressure within the building. Extreme care must necessarily be exercised in the use of these coils, in that exaggerated pitch must be provided for the coil, as well as the condensate piping, to insure proper drainage. Any "nonfreeze" coil will freeze when water logged. This also points up the need for proper trap selection and maintenance.

I do not wholly agree with the author's comments on the preference for roof exhaust fans over wall exhausters. We now have a good choice of wall type exhaust fans, made by reputable manufacturers, which will operate effectively at higher resistances than those mentioned. At the same time they enhance the appearance of a building. I will agree that roof type fans are the proper selection in wide buildings, can be located more nearly the source of heat stratification, etc., but wall type exhausters do have definite advantages when properly selected.

Mechanical fan systems offer another distinct advantage over gravity ventilators, in that a few fans, well located, will do a better job than many gravity type units symmetrically located. Local ventilation can also be obtained by operating only those fans needed.

H. P. KAULFUSS
Staff Engineer
Peoria Plant Engineering
Caterpillar Tractor Co.
Peoria, Ill.

THE AUTHOR'S REPLY — In building ventilation, exhaust is always very necessary. Mechanical exhaust is most certainly more satisfactory and dependable than natural exhaust in the vast majority of cases, particularly with wide low buildings. It was my intention to make this point clear in the article. However, it should be remembered that in some buildings, notably the high shed type having high temperature sources for convection (as in the metals industries), a well designed natural ventilation system may easily move 300,000 to 500,000 cfm. It would be uneconomical to provide mechanical building exhaust for such applications.

Makeup air is always the big headache. Everyone agrees that you can't take out what you don't put in. Illogically, many people do not associate this truism with industrial exhaust. Supply air of some sort must be a part of every exhaust system. It is the intention of this series of articles to emphasize this need for makeup air. Obviously, the makeup should be introduced as economically as possible and heat recovery should be given careful study in each case. This phase will be covered in a later article.

Wall heaters, where used with natural exhaust for air tempering should, in my opinion, be installed with the tubes vertical in every case to provide the best drainage and to reduce the freezing hazard.

Roof fans are preferable to wall fans because they can better remove the heat under the roof, are usually easier to maintain because of their location, and are less affected by wind conditions when reasonably well designed.

This has nothing to do with quality. Good fans are available for either wall or roof service. Regardless of quality, a fan operating at close to zero static pressure will be greatly affected when it is opposed by the wind, and relatively unaffected when discharging perpendicularly to the wind. Capacity of a quality

wall fan will swing from 25 percent or lower to over 100 percent as it is opposed or assisted (in a negative pressure on the leeward side) by the wind. This does not assure stable building ventilation. Such capacity swings are greatly reduced with roof fans.

JOHN H. CLARKE
Engineering Design Supervisor
Air Conditioning and Power
Visking Co.
Div. of Union Carbide Corp.
Chicago, Ill.

Vacuum's Good Points Outweigh Bad In Preventing Steam Coil Freezing

H. W. ALYEA's recent articles *Why Steam Coils Freeze* (April and May) are most informative and pertinent. No doubt his warnings and the suggestions he offers will be taken most seriously by consulting engineers to the end that many freeze-ups will be avoided. I only want to comment on his remarks about vacuum breakers.

He is quite correct in pointing out the danger caused by the freezing of condensate held up in the coil by the vacuum which can be formed—especially with a two-position on-off control. What has been overlooked, however, is that this vacuum can be of considerable help both in preventing freezing and in the overall temperature control.

A substantial proportion, perhaps a majority, of the larger steam heating systems have vacuum pumps. If such a pump is specified to be capable of evacuating condensate, air, and gases from the system at up to 25 in. vacuum Hg, and if "hot" returns from water heaters, kitchens, etc., are properly cooled before going to the vacuum pump or are taken to a separate condensate pump, then advantage can be taken of circulating steam through the coils at temperatures as low as 133 F.

Coils are usually sized, for low pressure work, on 5 psig steam pressure at the coil inlet. Capacity tables or correction factors are published for higher pressures as a guide for the original sizing of these coils for a given job condition, but it is not clearly shown what happens to this coil when pressures are reduced below atmospheric. It is not made clear, except by tedious calculation, how rapidly the capacity and final temperature fall as the pressures are dropped into the sub-atmospheric range. What is most important is that expansion of the steam is not indicated. It is this expansion which keeps the coils full of steam and helps prevent freezing. All these changes are far more rapid below atmospheric pressure than above it. By taking advantage of these facts, controlling the heat is much easier with simpler equipment at less cost. Why not make use of this situation rather than kill it by vacuum breakers?

It must be assumed that a modulating type of control is to be used since it is the only type suitable for sub-atmospheric steam operation. "Modulating" is defined as a control which produces a continuous flow of steam whenever any heat is required, but varies the steam flow in accordance with the need for heat at all times.

Ordinarily this valve would be positioned according to the temperature of the heated air by some thermostatic means. With this control only one simple step is necessary; i.e., a controller which will actuate the pump so that there is always more vacuum in the return line than in the coil. This produces a pressure differential across the trap and insures the proper elimination of condensate at all times. The vacuum in the coils greatly reduces the heating effect while, at the same time (due to the expansion of the steam), the coils are kept hot down to the trap. As the pounds of steam condensed go down, the volume of steam goes up. Thus the need for vacuum breakers is eliminated and it is no longer essential to have preheater coils to prevent freeze-ups, although some engineers may prefer to use them as an added precaution when using 100 percent outside air in severe climates.

It should perhaps be pointed out that it is only when the incoming air begins to warm up that the modulating action of the control valve begins to create a vacuum in the coil. This vacuum will keep on increasing until the maximum is reached in above freezing weather. While the coil should remain full of steam in freezing weather, it is always possible that some defect in the operation of the system might create partial filling of the coil.

To prevent freezing under this condition, a simple aquastat may be located at the return end of the coil. It should be set for about 100 F, so that if the return temperature falls below that point, the control valve will be forced open enough to admit sufficient steam to completely fill the coil.

It will be argued by some that a more costly vacuum pump must be used — even though a condensate pump might otherwise have been satisfactory. This is true. But the difference in cost may be counterbalanced by simplification of controls, by elimination of a preheater, and by better heating.

It will be argued by others that the high vacuum at the pump will not only be valueless for other heating equipment served by the same pump but may actually be detrimental to it. This is not true. High vacuum can almost always be used to advantage in the control and performance of this other equipment.

To my mind, it seems that control manufacturers should find vacuum so much to their advantage that they would recommend it instead of killing it with vacuum breakers. As for coil manufacturers, they might do well to include curves or tables in their catalogs to show the reduction in capacity at sub-atmospheric pressure, along with the increase in volume, so that everyone can more easily visualize what happens. The ASHAE Guide gives a table for variation in capacity for radiators and convectors.

(*Continued on page* 102)

Top heating performance by RECO atop the mile high city!

FIRST NATIONAL BANK BUILDING Denver, Colo.*

Going up! This seven-ton RECO tank recently climbed 28 stories to a permanent spot on top of Denver's First National Bank Building. Now it is there to stay. This copper-lined hydropneumatic storage tank is typical of all RECO engineered products — including the copper-silicon generators, pressure tanks, and heaters which were installed at First National in less spectacular fashion.

RECO offers you a complete line of heat exchange equipment. All equipment is ASME inspected and insured. Special linings are available . . . all standard metals and alloys are used. Our engineers are at your service. Call or write for free 20-page storage heater catalog containing tables, dimensions, diagrams and details. *Address RECO, Dept. B, 7th & Hospital Sts., Richmond 5, Va.*

CONVERTORS STORAGE HEATERS INSTANTANEOUS HEATERS HEAT RECLAIMERS STORAGE TANKS

RICHMOND ENGINEERING CO., INC.

*Mechanical Engineers, Marshall & Johnson; Mechanical Contractors, Natkin & Company; Architects, Raymond Harry Ervin and Assoc.; Mead & Mount Construction Co.; RECO Representative, F. G. Downs Co., Denver

A galaxy of reasons for saying

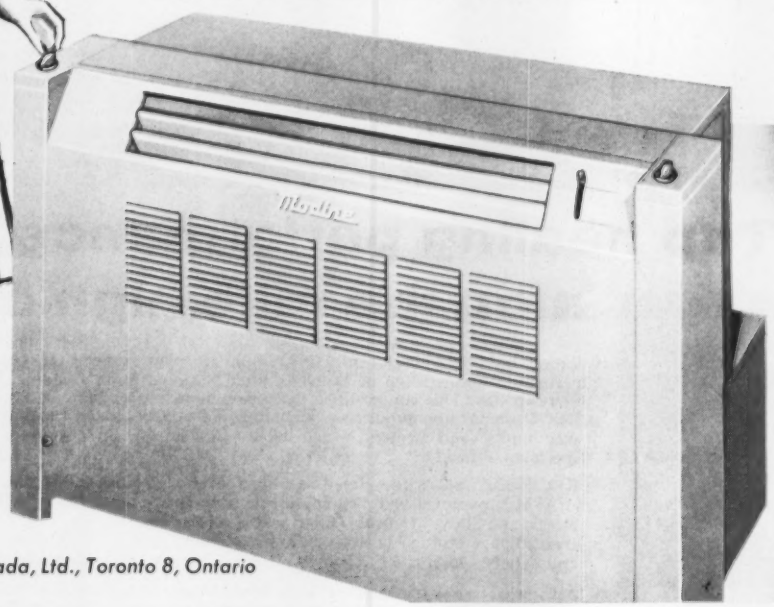
make mine MODINE

NEW SELF-CONTAINED Modine AIRditioner®

Here's four-season comfort plus individual room control, attractive styling, economical operation and installation.

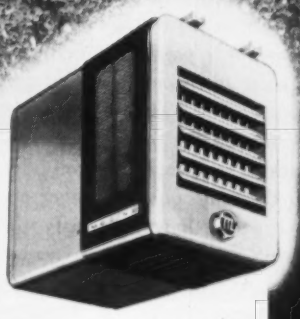
These versatile through-the-wall units incorporate 2-pipe steam or hot water heating with a self-contained refrigeration circuit. No duct work, drain lines or insulated piping needed. When replacing radiators they usually use the same piping.

Self-contained AIRditioners can be installed room-by-room or floor-by-floor — require no window space, leave no unsightly overhang. And they are easily hooked up to each tenant's meter. Write for Bulletin 758-SC, to Modine Mfg. Co., 1509 DeKoven Ave., Racine, Wis.



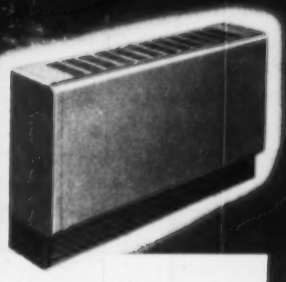
UR-1375

In Canada: Sarco Canada, Ltd., Toronto 8, Ontario

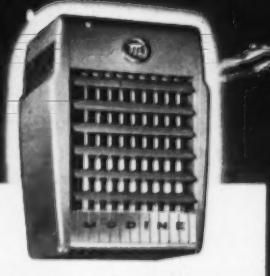


MODINE GAS-FIRED BLOWER-TYPE UNIT HEATERS.
For heating and ventilating. Seven models from 50,000 to 310,000 Btu. Catalog 658.

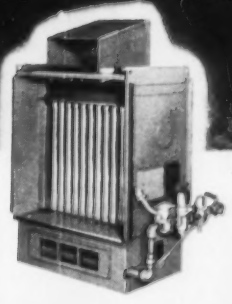
MODINE STEAM AND HOT WATER UNIT HEATERS.
Widest line available — horizontals, verticals, Power-Throws. Catalog 158.



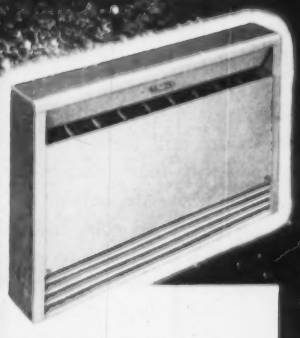
MODINE CABINET UNITS.
Provide quiet, positive heating, ventilating. Seven enclosure types — 120 to 640 Edr. Catalog 557.



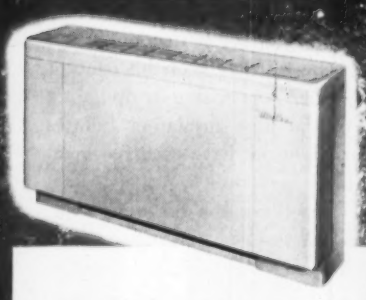
MODINE GAS FIRED PROPELLER-TYPE UNIT HEATERS.
Beautifully styled, lightweight, fuel-thrifty. Eight models. 25,000 to 310,000 Btu. Catalog 658.



MODINE DUCT FURNACES.
Ideal for air conditioning systems or straight heating. Five models, 88,000 to 213,000 Btu. Catalog 658.



MODINE CONVECTORS.
Offered in 30 types and 8,000 sizes for every building need. Choice of standard or heavy-gauge enclosures. Catalog 257.



MODINE CHILLED-WATER AIRditioners.
Cool with chilled water, heat with hot — from a central source. Four sizes, 2/3 to 2 tons. Bulletin 757.

Modine
MANUFACTURING COMPANY

(*Continued from page 98*)

Mr. Alyea speaks of the value of inner distributing tubes. He also says that they have their limitations and that at very low steam flow it is difficult to maintain uniformity of distribution. I have participated in a test of a schoolhouse unit ventilator which had these tubes and was able to confirm Mr. Alyea's remarks. At the same time, I can show how sub-atmospheric steam ironed out most of the trouble.

A number of mercury thermometers were laid evenly spaced along the outlet to read the temperature of the discharge air. Steam pressure at 3 psig was maintained up to the control valve which was of the modulating type. There was a thermostatic trap at the outlet of the coil and a condensate pump. The damper was set for all outside air which, during this test, was above freezing.

As the valve was throttled some thermometers began to read below others. It was found that these were located between the orifices of the inner tube — indicating that the outer tube was no longer completely filled with steam. The thermometers were juggled around until they were all directly over the orifices and read the same.

On further throttling until the steam flow had been reduced more than 50 percent, the thermometers near the return end began to read below the others. This showed that the inner tube was no longer fully filled with steam. Still further reduction in the steam flow resulted in the thermometers at the return end reading very little above the outside air temperature. The trap was starting to get cold, indicating the approach of a condition where a freeze-up could occur.

This test was then repeated with a vacuum pump and controller. The thermometers read the same no matter where they were placed. With probably less than 20 percent of full steam flow and with a vacuum of 25 in. Hg in the coil, the thermometers continued to read alike. This showed clearly how the expanded steam under the high vacuum was keeping both the inner and outer tubes full of steam, but at a temperature down to only 133 F.

An interesting exception to this was that one thermometer next to the inlet steam header was, under a vacuum, always a little higher than the others due to the superheat in the steam when reducing from a pressure of 3 psig to a vacuum.

LEWIS SMITH
Heating Engineer
Dunham-Bush, Inc.
West Hartford, Conn.

THE AUTHOR'S REPLY—Mr. Smith's comments are greatly appreciated and I am sure will contribute to the overall understanding of how best to avoid frozen steam coils.

The series of articles was not written with any thought that they would exhaust the subject. Rather it was hoped that they might stimulate or provoke others into offering additional comments. In discussing this subject with a number of people it has been the author's experience that almost everyone who has thought about steam coil freezing seriously has his own ideas regarding it. Many of these are good and should be added to what has already been written.

In asking vacuum breakers on the coil the objective, of course, is merely to assure a pressure differential between coil and return so as to encourage the proper flow of condensate. If an engineer chooses to use a high vacuum pump to reduce the return pressure, rather than a vacuum breaker to increase the coil pressure, he can accomplish the same purpose. Other advantages of this method would have to justify the higher initial and operating costs of the high vacuum pump.

H. W. ALYEA
Chief Field Engineer
Johnson Service Co.

Dewpoint Isn't Completely to Blame; Poor Vapor Sealing Is Real Culprit

I WAS very much interested in the article *What to Watch For When Insulating Air Conditioning Systems* (August), by Charles F. Gilbo, because of my interest in the subject of insulation. I was amazed at Mr. Gilbo's findings that in this age of excellent knowledge of the practice of insulation that such horrible structural and equipment situations could take place.

The dewpoint level in a particular area where cold insulated pipe lines exist is not in itself the whole cause of insulation failure. The moisture in the ambient atmosphere merely contributes to the failure. The real culprit is inadequate vapor sealing, be it under a ground supported concrete slab or on an insulated pipe line.

The ultimate in pipe line vapor sealing would be an installation that would permit an insulated line to operate successfully when totally submerged in water. For obvious reasons this degree of perfection is not quite obtainable, but I believe if one kept this concept in the back of his mind while supervising or designing an installation, some of the pipe insulation failures described by Mr. Gilbo might not have occurred or at least might not have been as severe.

Theory and practice sometimes can be miles apart if the insulation designer or installer does not appreciate the importance of a good vapor seal. Good design and supervision during installation, followed by good maintenance afterwards, will go a long way toward filling this gap.

On contract work, installation is carried out according to specifications. In this instance the burden of responsibility begins with the designer who writes the specifications. If, due to lack of knowledge or because of first cost limitations, only fair workmanship is called for, or, in some cases, left up to the insulation contractor, then the success of the job is in doubt.

The building damage described by Mr. Gilbo which was caused by excessive ambient moisture conditions and unanticipated ground water conditions is unfortunate and costly. In some instances these might have been avoided or at least materially reduced had the ground supported concrete slab been poured on a previously placed vapor seal. This observation is not hindsight, but just plain common sense. It can be assumed from the author's study that some of the structures examined by him were poorly engineered — if engineered at all.

Mr. Gilbo effectively describes what can happen when not enough care is exercised, or competent and qualified engineering is not made use of when public structures are contemplated. One can have little sympathy for an owner who allows an insignificantly small difference in cost to stand in the way of his obtaining competent engineering.

If and when the desperate owner finally is obliged to engage competent engineering advice, the engineer so engaged must be possessed of unusual ingenuity, skill, and experience in order to satisfactorily recover a bad situation with the assurance that the additionally spent funds are soundly spent.

Whether all of Mr. Gilbo's recovery recommendations worked out are not stated in his article, but it certainly can be assumed that the owners of the structures derived appreciable benefit from the surveys he made.

To sum up, the article is down to earth but rather academic. However, it should serve a useful purpose — especially to younger engineers.

JAMES H. SHAW
Director
Laboratory Services Dept.
Carrier Corp.
Syracuse, N.Y.

One Large Fan for Entire Building Will Avoid Air Short-circuiting

THE ARTICLE *Sheet Metal Ducts Are Solution to Critical Stack Effect Problem* (June), by Lewis Smith is very good.

Years ago every young architect admired the picture of Empress Eugenie walking down a gaudy circular stairs. Later, when he became a practicing architect he had to design such a stair and keep on designing similar open stairs for full building heights.

These created the chimney effect which produced so many problems in heating buildings and also formed the world's worst fire hazard. Fortunately, building departments, fire departments, and especially the National Board of Fire Underwriters could see no beauty in Empress Eugenie stairs and insisted on enclosed stairs with fire doors at each landing. Thus, this chimney effect in stairwells was licked.

Now a small amount of chimney effect still persists in vertical ventilating ducts. This need not be given any consideration in the calculation of radiation, especially when individual thermostatic room controls are used.

In properly constructed pipe shafts the fire ordinances require that they be continuous and of at least two-hour fire resistant construction, with no openings to any portion of the building except from the bathrooms or kitchens to be ventilated. These are to consist of registers with 22 in. long boots turning upward in lieu of fire dampers. Evidently in the troublesome installations cited by Mr. Smith, the fault was in the lax enforcement of these fire ordinances.

It is utterly impossible to balance the air outlets of an exhaust ventilating system, as the air intake into the various apartments varies continually from minute to minute and hence the air to the outlets is in a constantly varying pressure state.

Lining the pipe shafts with sheet metal is a costly procedure and it will not materially surpass a properly constructed unlined pipe shaft.

Onions being fried will smell on the leeward side of a frying pan outdoors in a storm. The solution to this problem is out of the range of ventilation. Rather, it requires considerable research by horticulturists, agriculturists, etc., in the production of tamer onions.

This office recommends the use of one large fan for all the kitchens and all the bathrooms of the building. This will avoid short-circuiting air from the kitchen duct to the bathroom duct when the kitchen fan is not operating, and vice versa. Also, provide a closeable register at each air exhaust outlet, so same may be closed when there is a back-lash of undesirable odors.

ERWIN L. WEBER
Consulting Engineer
Seattle, Wash.

Compare Heat Producing Effects of Fluorescent, Incandescent Lights

ITEM 8 in the July Data Sheet, "*How to Cut Cooling Costs*," by Willie Hammer, advises the use of fluorescent lighting in lieu of incandescent. This statement has misled many a layman to believe that, watt for watt, the heat producing effect of the fluorescent tube is less than that of the incandescent lamp.

It should be clarified at this point that the Btu per hr heat gain of a fluorescent lamp is 20 percent greater than an incandescent lamp of the same wattage rating when the fluorescent lamp ballast is contained within the space being calculated.

We feel certain that what the author was trying to convey was the fact that the net illumination effect can be obtained with fluorescent lamps of lesser wattage than can be obtained with the incandescent.

RALPH S. SEGALL
Mechanical Engineer
Segall Co.
Engineers & Contractors
Shreveport, La.

Question of the Month

Should Air Be Recirculated After Cooling Electric Office Machines?

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with answers that have been received from readers. Other answers or comments for publication are invited.

"Is it more economical to exhaust room air to the outdoors which has been heated in cooling electric office machines such as IBM equipment or to recirculate this air back through the air conditioning equipment?

The conditions inside the building are 75 F dry bulb and 50 percent relative humidity. The temperature of the heated air being exhausted from the building is 90 F. The outdoor design conditions are 100 F DB and 78 F wet bulb. These design conditions are close to the maximum temperatures ever recorded, so the frequency at which they occur may be very low.

"Comments from other HPAC readers on this will be greatly appreciated." — J.H.

Recirculate Air By Mixing It With Sufficient Outside Air

J. H.'s REALIZATION that air at 90 F DB might be more loaded than air at 100 F DB is well founded. However, in this case the outside air is loaded with the latent heat which imposes the high cooling load. Since we are not made aware of the geographical location nor the source of the design conditions, we must base our answer only on what is stated in the question.

On the assumption that the outside design conditions are authoritative and that the system being discussed has no recirculated air from areas other than the business machine space, we can definitely recommend recirculating the air after cooling the office machines and mixing it with sufficient outside air for ventilation purposes.

Our reasoning is as follows:

1) The office machines do not affect the air with respect to odor or pollution. The machines add only sensible heat to the air, and therefore it is only this sensible heat that must be removed.

2) If we assume that in the business machine space there are sufficient people or other sources of latent heat to result in a sensible heat ratio of 0.93, the air being discharged into the space at 90 percent saturation would be at 56.3 F DB and 54.6 F WB. The enthalpy or total heat of the air at this point is 22.9 Btu per lb of dry air. The enthalpy of air at the outside conditions is 41.58 Btu per lb of dry air. The difference in enthalpy is 18.68 Btu per lb and represents the heat that must be removed when using 100 percent outside air.

3) When the air is in the room at 75 F DB and 50 percent RH and is then passed over the office machines to be heated to 90 F, its enthalpy at the latter state is 32 Btu per lb. The difference between this point and that of the air discharged into the room is only 9.1 Btu per lb, less than 50 percent of the former difference. This is an actual saving in refrigeration load which would be reflected in original equipment cost as well as operating cost.

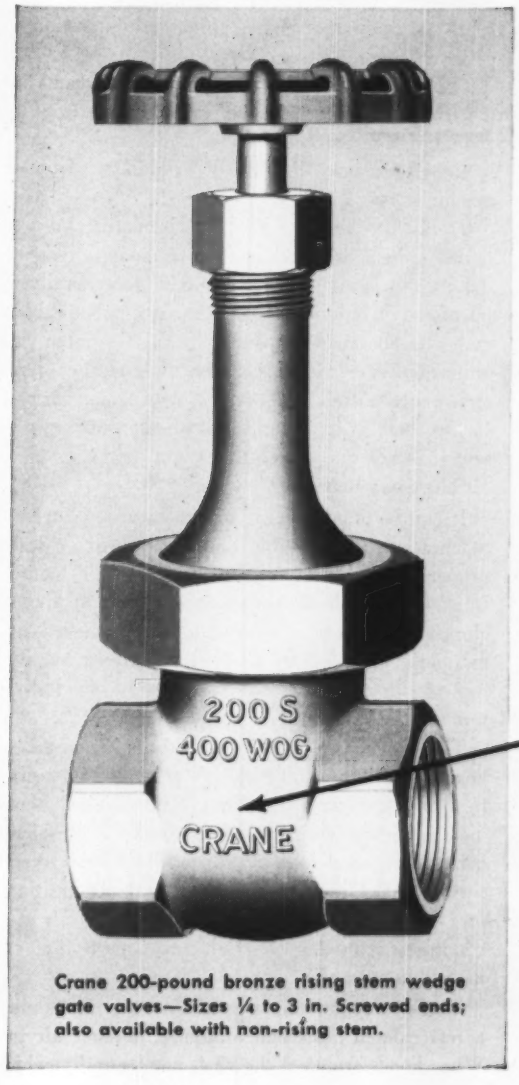
4) If 25 percent outside air and 75 percent air from the office machines are mixed before entering the air conditioner, the result will be a mixture with an enthalpy of 34.3 Btu per lb. In this case the difference in enthalpy is 11.4 Btu per lb, a substantial saving over the system where 100 percent of the air is exhausted.

5) Any mixture of recirculated and outside air at the conditions stated above will show a reduction in refrigeration load as compared to the use of 100 percent outside air. The degree of saving will be in proportion to the amount of recirculated air.

Plotting the various points on a psychrometric chart will provide a visual means of determining what must be done and what can be done.

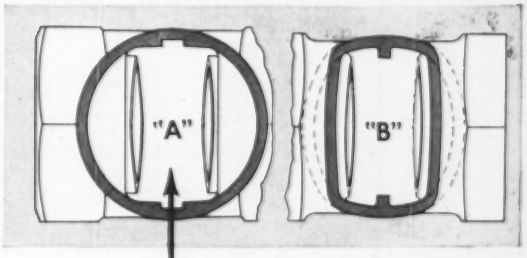
MILTON DORMONT
Professional Engineer
Paterson, N.J.

(Continued on page 106)



Crane 200-pound bronze rising stem wedge gate valves—Sizes ¼ to 3 in. Screwed ends; also available with non-rising stem.

Crane cylindrical body design ("A") distributes pressure load uniformly, resists distortion, prevents possibility of seat leakage under higher pressures. In ordinary, rectangularly shaped bodies ("B"), stresses concentrate where walls have shortest radius. Leakage and early failure may result from excessive deflection, and rupture may occur.



HERE

CRANE adds new strength and safety to 200-Pound Bronze Gate Valves

Here is a bronze gate valve body design that provides essential strength where internal pressures are greatest . . . where line strains are most likely to concentrate.

And that's not all you get. The Exelloy seat rings are expanded into the body so that they can't loosen. There are wider hex ends which give easier, firmer wrench grip and resist distortion.

Another quality feature that Crane offers is the shoulder at the bottom of the threads in port ends to restrain the excessive entry of pipe that could cause damage to the valve seats.

You will find many uses for Crane 200-pound bronze gate valves in your plant—on steam, water, oil, gas, air, gasoline, light oils and volatile fluid lines.

For complete information about these new Crane bronze valves, see your local Crane Representative, or write to address below for Circular Ad-2285.

Send for Circular Ad-2285 today.

CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill.—Branches and Wholesalers Serving All Areas

(*Continued from page 104*)

Evaluate Total Operating Expense And Make Decision Accordingly

FIG. 1 is an elementary diagram showing thermal conditions with all air exhausted to the atmosphere (100 percent makeup). For this arrangement, total heat removed by the conditioner is approximately 13.2 Btu per lb of circulated air.

Fig. 2 shows similar relations for an arrangement having 70 percent recirculated air and 30 percent

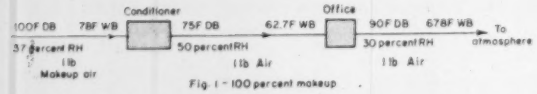


Fig. 1 – 100 percent makeup

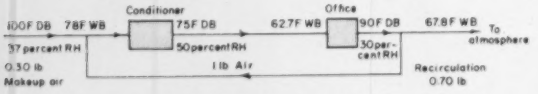


Fig. 2 – 70 percent recirculation

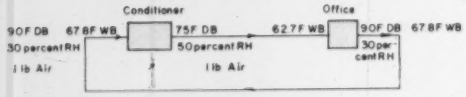


Fig. 3 – 100 percent recirculation

makeup. This design involves an estimated cooling load of 6.6 Btu per lb.

The arrangement indicated by Fig. 3 depicts thermal relations attendant with 100 percent recirculation (zero makeup), having a heat load of 3.8 Btu per lb.

A comparison of these diagrams shows that least cooling needs are available with the scheme having 100 percent recirculation, whereas maximum cooling load prevails with zero recirculation. Knowing respective air flow rates and cost for utilities, J. H. can evaluate total operating expense and select accordingly.

Frequently, allowable maximum recirculated air quantities are defined by state, municipal building, health, and labor codes which will affect the ultimate decision.

H. B. WAYNE
Consulting Engineer
Woodhaven, N.Y.

Consider Supply, Exhaust Methods For Cooling Office Machines

IT IS ASSUMED that the equipment in question comprises a large scale computer.

There are many ways of routing air streams under the conditions given but the problem appears to be:

1) Can exhaust hoods be efficiently and economically used to remove the heated exhaust air from these machines, or

2) Should the room air be recirculated and a minimum outdoor air intake be maintained?

Large scale air cooled computers are generally made up of many individual pieces of equipment cabled together to operate as an integral unit. The room volume is normally restricted because of computer requirements such as raised floors, etc. As a result, air motion in the room is important as it affects working personnel. It is not uncommon to have as many as 45 to 60 air changes per hr.

It can be assumed that if hoods are used over these machines where possible and the system is designed properly, less air motion will be felt in the room area. It is not possible in most cases to hood all these machines, so the entire load cannot be removed in this manner. Hooding can be used effectively but it does destroy the mobility and flexibility of the individual units in the installation.

These machine room air conditioning systems are generally designed on the basis of maximum recirculation and minimum outdoor air intake since the heat load is almost entirely sensible and the problem becomes simplified as a result of this. The peak conditions of 100 F dry bulb, 78 F wet bulb are limiting factors to the extent that if a large amount of air at these conditions is used, considerable air conditioning capacity will be wasted.

These computer rooms generally have air handled on a recirculated basis and minimum outdoor air intake. When hoods are used, the air is not generally exhausted outdoors. This allows conditions to be calculated at all times, saves tonnage, and reduces air motion in the computer area.

D. E. WENDEL
Manager of Field Engineering
Cambridge Filter Corp.
Syracuse, N.Y.

READER ASKS—

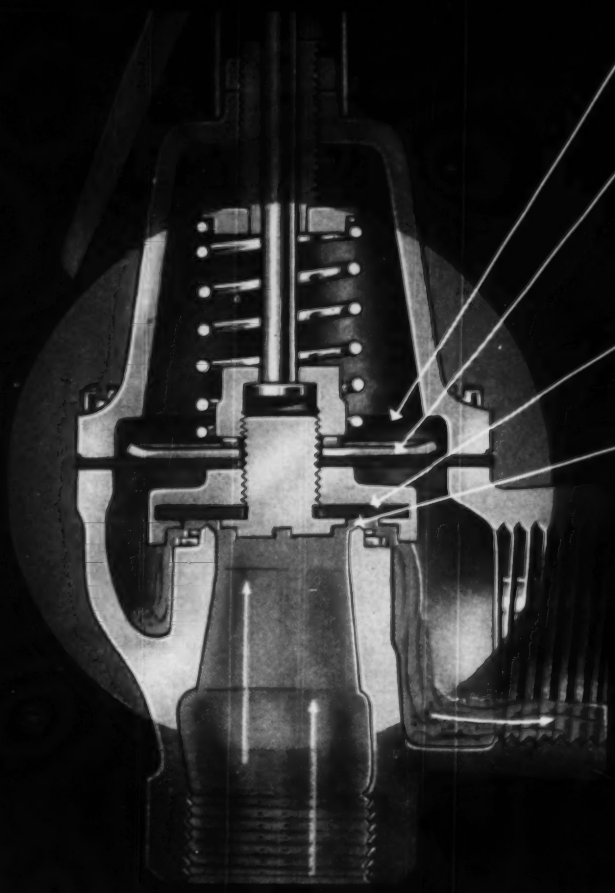
"How Can Fan Be Cleaned?"

"A large centrifugal fan exhausts air containing sal ammonia from an industrial process. The fan becomes heavily coated with this chemical within a very few days and must be thoroughly cleaned often.

"What is the most effective method for cleaning the impeller and housing for this fan?"
—C.S.G.

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

WHAT DO YOU LOOK FOR IN ASME PRESSURE SAFETY RELIEF VALVES?



Double-Safe Design — No mechanical guides—not diaphragm operated.

Water Seal — Provides precise alignment of seat to disc eliminating need for hazardous mechanical guides which can stick or freeze a valve shut from lime or corrosion.

Stickage-free Disc-to-Metal Seating — heat resisting, stickage-proof silicone disc material.

Positive Pop Action — Valves operate by pressure exerted directly against **the disc** to pop valve wide open for steam relief. Operation does not depend on diaphragm, thus diaphragm rupture cannot cause valve failure.

Corrosion-Resistant — All parts constantly in contact with water are commercial bronze. Other parts are of nonferrous material. No dissimilar metals used.

ENGINEERING DESIGN

The most advanced design in A.S.M.E. rated pressure relief protection for hot water boilers is the new *Double-Safe* design of Watts Valves.

These are water pressure relief valves with an *emergency* steam rated pressure safety relief feature. They will discharge excessive water pressure created by thermal expansion and also excessive steam pressure in the event of emergency temperature conditions.

FULL SELECTION OF SIZES

Watts offers the most complete line of boiler safety relief valves with the 174A Series and 74A-740 (expanded outlet) Series. Designed to meet the smallest or largest requirements for pressure protection from one line of valves, Watts A.S.M.E. Rated Relief Valves furnish complete protection for the great majority of hot water heating and supply boilers *with a single valve.*

Watts Regulator Company · Lawrence, Massachusetts

Watts A.S.M.E. Rated Pressure Relief Valves are available in capacities from 500,000 BTU/HR to 14,370,000 BTU/HR with valve settings from 30 to 150 lbs.

Be on the safe side with

WATTS

Protection and Control Specialties

For complete Specifications,

Ratings, and Application Information on Watts A.S.M.E. Rated Valves, see your wholesaler or send for Bulletin F-ASME.

NO NEED TO WORRY...STEEL PIPE RADIANT HEATING WARMS THE FLOOR

In true radiant heating, *steel pipe* heating coils are usually embedded in the floor itself, providing safe, gentle, permeating warmth. All over the country new schools are incorporating *steel pipe* radiant systems for this sun-like heat . . . without hot or cold spots, drafts, or dust-laden currents.

Steel pipe is, of course, preferred for all forms of hydronic heating . . . proved in three-quarters of a century of use.

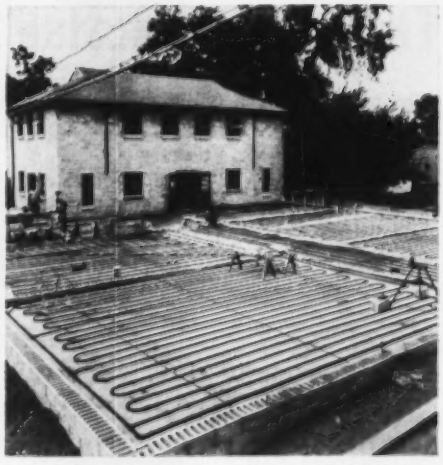
As in hydronic heating, *steel pipe* has hundreds of other applications because it is not only the least expensive but also the most versatile of metal tubular products. That's why it is the most widely used pipe in the world . . . for radiant heating, snow melting, refrigeration, fire sprinkler systems, vent and drainage lines, electrical conduit, structural uses, gas, oil and water lines.

Write for the free 48 page color booklet "Radiant Panel Heating with Steel Pipe."

STEEL PIPE IS FIRST CHOICE

- Low cost with durability
- Strength unexcelled for safety
- Formable—bends readily
- Weldable—easily, strongly
- Threads smoothly, cleanly
- Sound joints, welded or coupled
- Grades, finishes for all purposes
- Available everywhere from stock

INSIST ON PIPE MADE IN U.S.A.



Steel Pipe radiant heating grids being installed in four-room school addition for uniform, healthful heat.

COMMITTEE ON STEEL PIPE RESEARCH

AMERICAN IRON AND STEEL INSTITUTE

150 East Forty-Second Street, New York 17, N.Y.

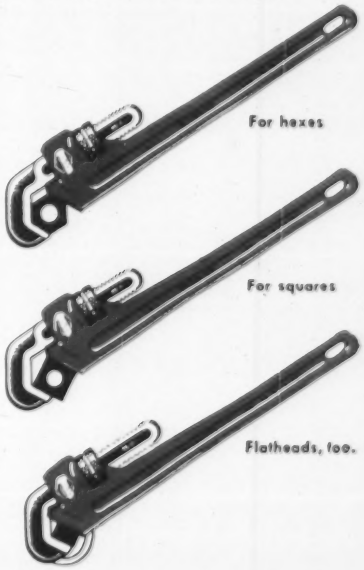
Pat. Applied For

New RIDGID Hex Wrench

gives you Time-Saving, Positive, 4-Sided Grip on Hex Nuts, Square Nuts, Valve Packing Nuts, Unions, Gas Cocks

Here's the adjustable wrench you've always needed for hexes, squares and flatheads, rough or finished. Extra-useful on every job. No more skinned knuckles or rounded nut shoulders. New wide-open jaw goes on easy . . . won't slip off. 4-sided grip gives extra leverage. Stays to adjusted size during use.

Famous RIDGID heavy-duty construction with guaranteed housing. Narrow jaw design makes work easy in tight places even on thin nuts. Comfort grip I-beam handle has handy hang-up hole. The new RIDGID Hex Wrench gives you more for your money than wrenches costing twice as much. Try it, buy it at your Wholesaler's.



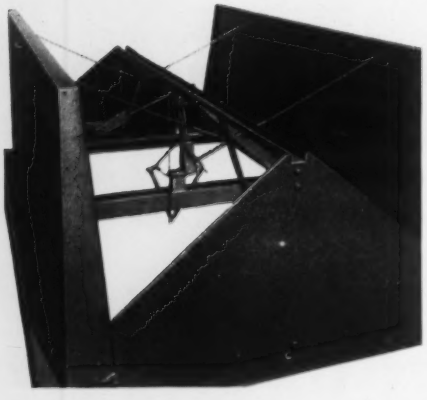
Available in 3 Sizes

- **No. 11, 3/8" to 3/4"**
- **No. 17, 5/8" to 1 1/4"**
- **No. 25, 1" to 2"**

The Ridge Tool Company • Elyria, Ohio, U.S.A.

New Improved **Pyrojector** Design

. . . gives more **Fire** and **Explosion Control** for industrial plants, auditorium stages, stairwells, elevator shafts



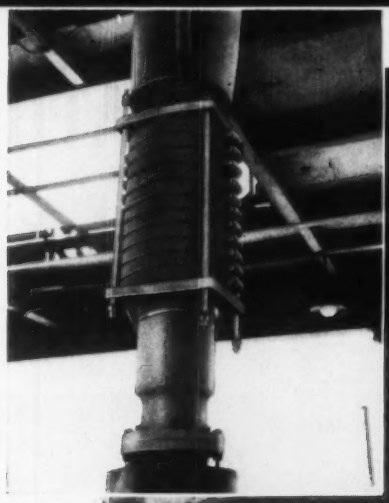
With Swartwout Pyrojectors you get positive fire and explosion control worth many times the small investment involved. Favored by insurance authorities, automatic release of heat, smoke or explosive blasts holds plant damage to a minimum.

Double-walled, thickly insulated and weather-tight dampers fly open when underwriters-approved fusible link melts at 212° F. Snubber springs and chains hold dampers vertical for maximum draft. Pyrojectors provide 28 square feet of free escape area.

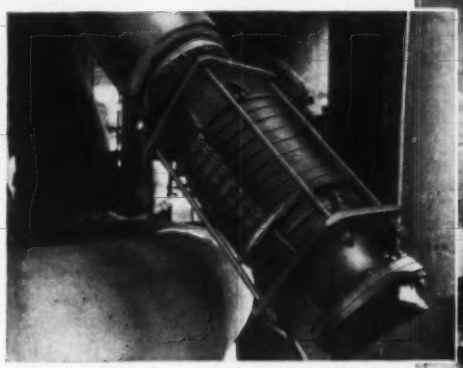
Write today for full information about valuable Pyrojector fire and explosion control.

- **Stronger Spring** for positive automatic damper opening at 212° F. — even under load!
- **Extra-Rugged Damper Construction** for lifetime tight fits . . . eliminates leaks!
- **Improved Insulation** bonded securely to new square dampers prevents condensation, ends annoying dripping.
- **Fast, Easy Installation** — just one easy-to-make opening (between roof beams).
- **Handy, Extra Heat Relief** when needed. Opens easily with release chain, or by hand from roof.

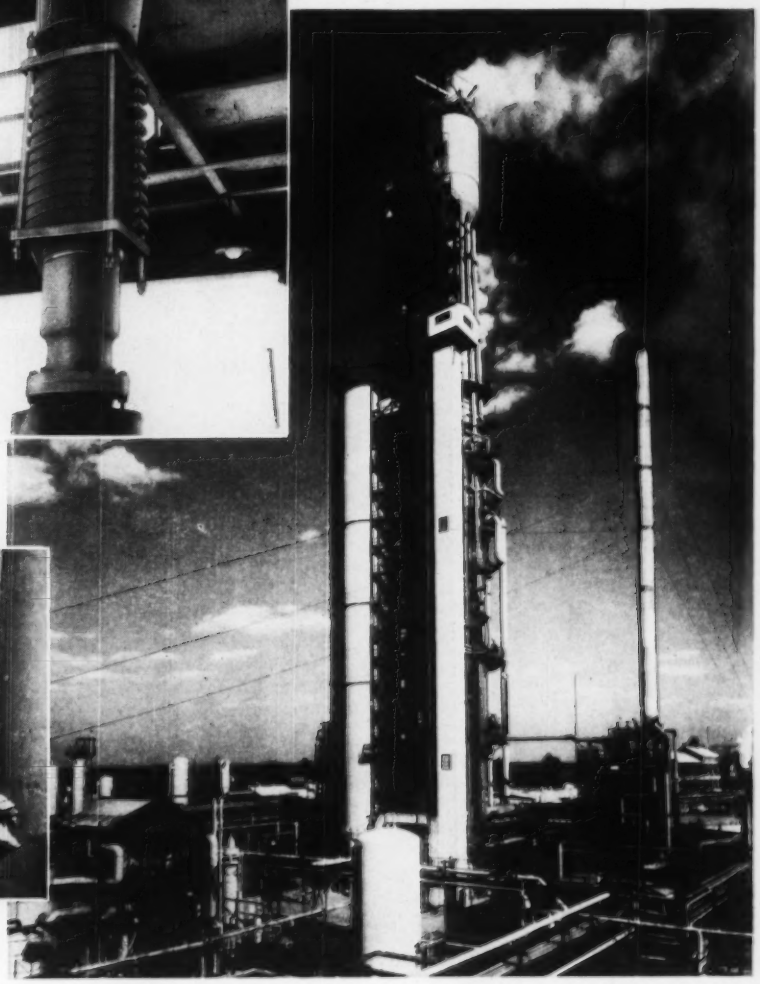
The Swartwout Co.
Ventilation Engineering
18568 Euclid Avenue Cleveland 12, Ohio



ADSCO Corruflex Expansion Joint with #316 stainless steel element. From the position of the tie-rods, note the pipe movement the joint is absorbing.



In this section of the Houdriflow unit, there are 12 ADSCO Corruflex Expansion Joints with #316 stainless steel elements. Temperature here is 1100°F.



Houdriflow Catalytic Cracking Unit, Marcus Hook Refinery, Sun Oil Co.

LET THE PIPES SQUIRM . . .

ADSCO

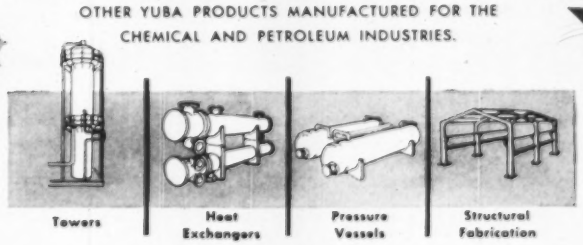
EXPANSION JOINTS ARE ON THE JOB!

Here, at the Marcus Hook Refinery of Sun Oil Co., temperatures run high. The piping naturally moves around a bit. But Sun engineers don't worry because they installed 62 Adsco Corruflex Expansion Joints to take the movement. Lateral offset, angular rotation, off-tackle slants... name it and Adsco Expansion Joints can absorb it. If you expect your pipes will get frisky, call our nearest sales-engineer, *or contact Adsco Division, Yuba Consolidated Industries, Inc., 20 Milburn St., Buffalo 12, N. Y.*

YUBA CONSOLIDATED INDUSTRIES, INC.

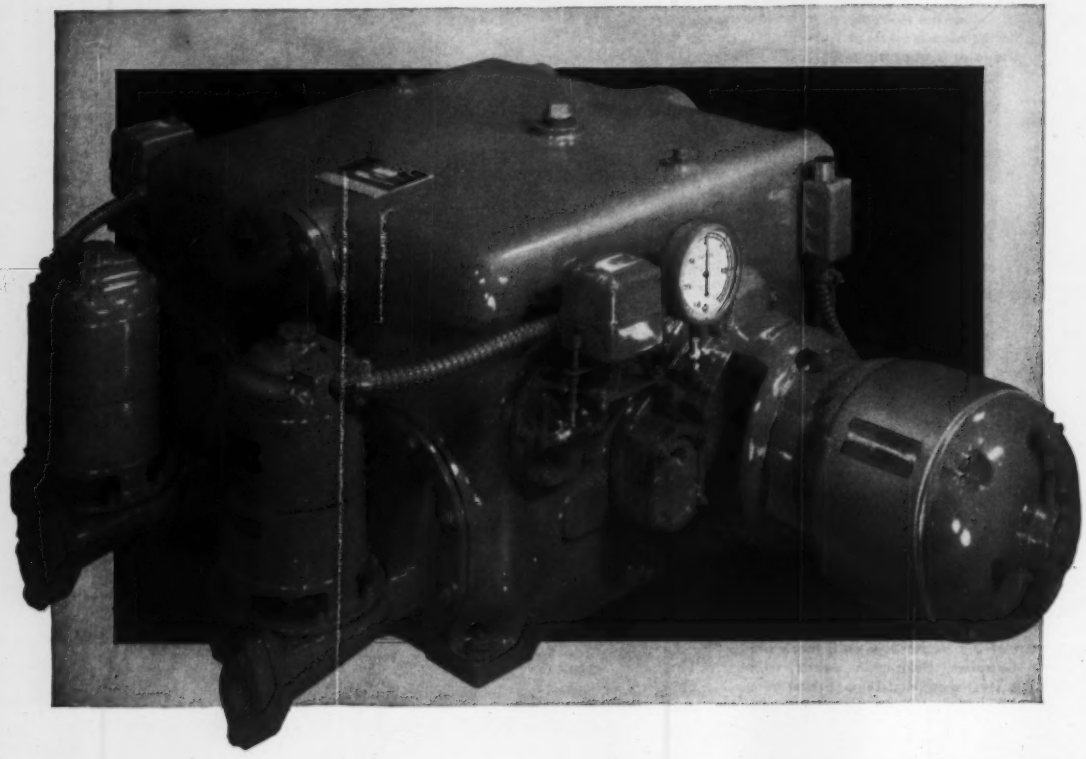
OTHER YUBA PRODUCTS MANUFACTURED FOR THE CHEMICAL AND PETROLEUM INDUSTRIES.

YUBA



THIS NEW VACUUM HEATING PUMP

HAS THE INCREASED AIR CAPACITY EFFICIENT HEATING PRACTICE DEMANDS



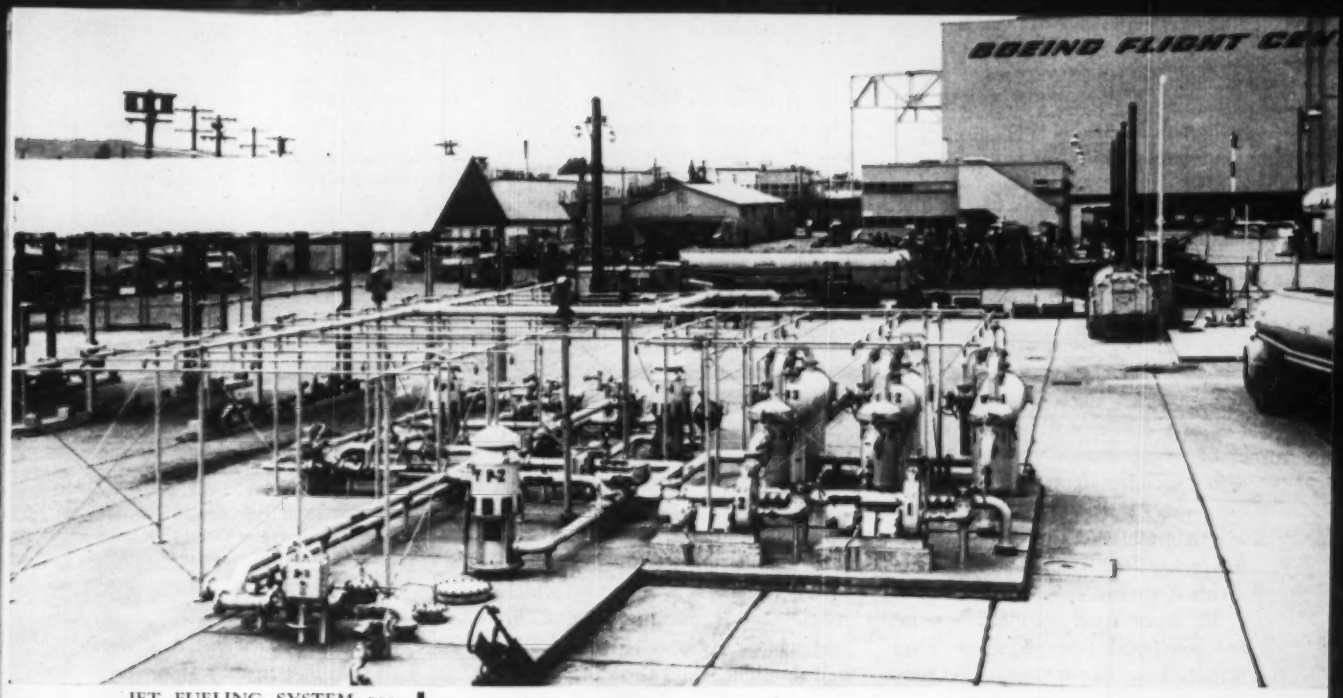
It's the Nash CSM

Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
437 WILSON, SO. NORWALK, CONN.



JET FUELING SYSTEM provides pumping, filtering, dehydration, metering of fuel to one aircraft at 1200 gpm, or to two aircraft simultaneously at 600 gpm each, at any of four fueling positions

Jet Fuel Piping Delivers 1200 Gpm to "Stratofort"

Boeing's B-52 preflight facilities simulate actual U.S. Air Force jet fueling rates, also permit special test functions beyond normal operation. Design criteria included storage of 120,000 gal of jet fuel, defueling of two aircraft simultaneously at 200 gpm each, facilities for unloading fuel trucks, fuel dispensing to mobile truck refuelers, fixed fire protection for system and aircraft in fueling position.

BY R. H. SCHAIRER
Bouillon, Griffith & Christofferson
Consulting Engineers

THE recently completed preflight facilities for jet aircraft at Boeing Field, Seattle, are the answer to a critical national defense need. These facilities are necessary to permit production testing and checking of the B-52 "Stratofort" produced by the Boeing Airplane Co. in preparation for initial flight.

Among other needed facilities, a hydrant fueling system was required for the functional testing and servicing of B-52 aircraft with jet fuel. This system would simulate the nor-

mal ground fueling rates to be encountered by the aircraft in operational service with the United States Air Force, and would also perform special test functions in excess of normal operational requirements.

Standard Systems 600 Gpm

The standard air force hydrant refueling system presently installed at many operational bases will deliver fuel to a standard aircraft at a rate of 600 gpm. These systems will also defuel an aircraft at 200 gpm. Performance of these standard systems will naturally vary, depending on the fuel system characteristics of the individual aircraft type.

All flows from standard systems are conducted through single point fittings designed for pressurized fueling and are normally situated low on the aircraft. The standard single point assembly conducts refueling, and defueling flows through a valve opening which is directly connected with the fuel system piping of the aircraft.

In addition to the normal requirements for servicing, certain special tests were contemplated that require that the hydrant system be capable of forcing excessive rates of flow through the single point assembly. Also, the ability to store, meter, and dispense fuel through the hydrant system or to mobile refueling trucks was considered necessary in order to support other functions of the facility. These requirements involve the normal day-to-day receipt of fuel from vendor trucks, the storage and transfer of fuel received, and the dispensing of fuel either to tank truck refuelers or directly through the hydrant system to B-52 aircraft.

The problem of bulk storage normally associated with high speed hydrant refueling systems was not a consideration in this project. Instead, use is made of the commercial vendor's existing bulk storage facility. Truck transports convey the jet fuel from this point to Boeing's operational storage.

A problem of pressing importance in this instance was that of providing maximum safeguarding against fire and explosion. Not only is the fueling and preflight facility within a metropolitan area and adjacent to the manufacturing plant itself, but when initially towed into fueling position each airplane is receiving fuel for the first time. The chances of substantial leakage therefore exists, as well as does the constant threat of accidental spilling.

List Specific Design Needs

The fueling facility was designed principally to fill the following requirements:

1) Operational storage of 120,000 gal of jet fuel (JP-4)

2) Pumping, filtering, dehydration, and metering of fuel to one aircraft at a maximum rate of 1200 gpm, or to two aircraft simultaneously at 600 gpm to each, at any of four fueling positions

3) Defueling and fuel metering from two aircraft simultaneously at 200 gpm from each aircraft

4) Facilities for unloading vendor trucks

5) Dispensing to mobile truck refuelers for remote fueling of aircraft

6) Fixed fire protection for aircraft in hydrant fueling positions and for vendor tank trucks and mobile truck refuelers while delivering or receiving fuel.

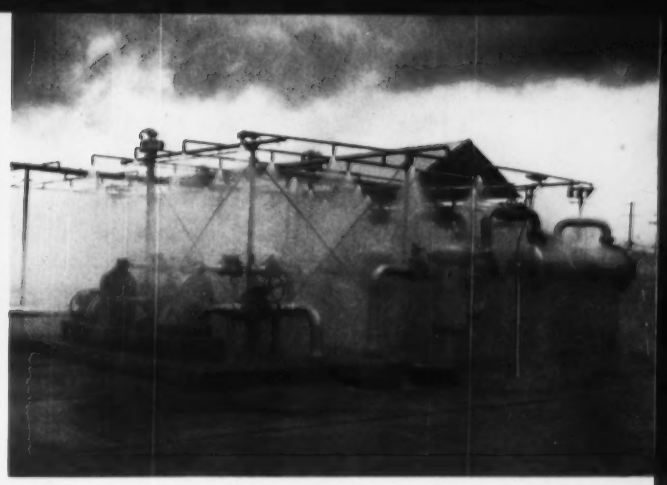
How These Needs Are Met

Taken in the order listed, design of the individual items was resolved as follows:

1) *Storage*: Three 40,000 gal, horizontal, cylindrical, underground storage tanks are provided. Construction is welded steel, meeting the requirements of the National Board of Fire Underwriters. The tanks are equipped with nozzles and openings required for the installation of pump, tank fill, liquid level gage, gage hatch, high level shutoff, and low level pump controls.

Uplift flotation force is 5420 lb per linear ft, or a total force of 342,000 lb. These forces are restrained by a concrete anchor slab above the tanks.

ALL VALVING to pumps, headers, and tanks (except fueling valve which is controlled locally) is controlled remotely by single operator. This is accomplished by electric motor operators which are controlled from central console located in this observation tower



UNIQUE FIRE PROTECTION system includes fixed protection for aircraft provided by automatic foam system (left) with nozzles installed in enclosures mounted on apron paving and arranged around aircraft, and water fog curtains (right) which are provided between positions with nozzles also set in apron paving. Both systems are started automatically by heat-actuated device mounted above fueling hydrant and meter stations, and manually from control tower

Tanks are 10 ft, 6 in. in diameter × 36 ft long. Shell and head plates are welded and are ½ in. thick. Reinforcing rings consist of five structural angles welded to the shell, and welded flat bar stiffeners on the heads. Tanks were coated and wrapped and the excavation backfilled with select material.

2) *Pumping, filtering, dehydration, and metering*: Each storage tank is equipped with a vertical turbine pump rated 600 gpm at a total dynamic head of 450 ft. Pumps are driven by explosionproof 75 hp motors operating at 1750 rpm.

Pump discharges are equipped with flow rate controls to limit and regulate flow at 600 gpm. This feature is primarily intended to limit system flow to 600 gpm when only one pump is operating. Fuel flow from the pumps is discharged directly to headers capable of being valved to other tanks, the tank truck loading rack, or the aircraft refueling hydrants.

De-rate Separators to 400 Gpm

Dehydration is accomplished by three standard excelsior type (later modified to cellulose type) fuel-water separators. Two of the separators were owner-furnished and were rated at 600 gpm aviation gasoline flow. An identical third separator was connected in parallel with the two existing units. The separators were then each de-rated to 400 gpm of jet fuel flow, thus providing for a maximum system performance of 1200 gpm when needed.

Separators are equipped with automatic water drain, air elimination, water slug shutoff, and flow rate control set at 400 gpm. Control of flow rate is necessary to equalize flow through the three separators in parallel, and to limit this flow to 400 gpm in each separator when operating at maximum system capacity of 1200 gpm. Water sumps on the separators have insulated and electrically heated enclosures.

High Separation Efficiency

Separation efficiency had to be in accordance with the performance requirements established by the U. S. Army Corps of Engineers, and is approximately 99 percent. Fuel flow from the separators passes directly to micronic filters designed to remove all foreign particles greater than 5 micron size. The performance requirements for these filters were also based on Army standards. Because final filtering occurs in this stage, all piping downstream was specified to be aluminum. This requirement also included the body and shell of the micronic filters and prevents the pickup of scale particles after the final filtering stage.

From the micronic filters, the fuel enters aluminum pipelines which deliver the flow to each hydrant on the fueling apron. These pipelines were coated, wrapped and then buried directly beneath the apron pavement.

At each hydrant the piping emerges from the paving and connects to the hydrant assembly which is mounted on supports above the paving and enclosed by security fencing. The hydrant assembly consists of a surge arrestor, a three-port two-way fueling valve, a meter, and a manual control valve with a 4 in. hose connector.

A venturi throat section is installed ahead of the coupler to provide a sensing point which is used to modify operation of the fueling valve in such a manner as to limit pressures to the delivery point to 50 psig (± 1 psig) at all flow rates up to 1200 gpm, with a 54.5 psig no-flow condition. The connection from this valve to the single point assembly on the aircraft is direct by way of 50 ft of 4 in. refueling hose equipped with a single point fueling nozzle. The surge arrestor is a diaphragm type, pressurized with nitrogen.

Valve Controlled Automatically

The fueling valve is automatically controlled to assume a refuel or defuel position. Refuel flow is directly through the valve from the refuel pipeline through the meter to the hose connection. Defuel flow is reversed from the aircraft through the

hose and meter to the fueling valve and defuel pipeline. Defuel flow is then conducted through a separate pipeline to the fill header to the fuel storage tanks.

The fueling valve is controlled by the local operator through a portable hand control button, cord, and solenoid on the valve itself. Direct control of the valve is by compressed air. Pushbutton control by the operator is based on the "deadman" principle, requiring a continually maintained depression of the button to operate the fueling valve. All controls are arranged to "fail safe." Fuel is metered during both refuel and defuel flows.

The meters have aluminum bodies and are equipped with direct reading flow indicators and totalizing counters. The rated capacity of each meter is 600 gpm. Provisions were made in the piping system for mounting a second meter in parallel to record flow at 1200 gpm. One extra meter is provided for this purpose, and can be mounted at any hydrant as the occasion requires. Provision was also made for the parallel connection of the second meter to the flow rate indicator and totalizer at each hydrant.

Except for the fueling valve, which is controlled by the local operator, all other valving to pumps, headers, and tanks is controlled remotely by a single operator. This is accomplished by electric motor operators on the valves, controlled from a central console located in an observation tower overlooking the fueling apron, tank farm, and tank truck loading rack. Pumps are also controlled from the console, and tank levels are supervised by means of remote reading liquidometers with indicators mounted in the tower.

Defuel Aircraft at 200 Gpm

3) *Defueling*: Defuel pipelines are connected to the suctions of two self-priming defueling pumps. Each pump is rated 200 gpm and is capable of high suction lift. Defuel flow is passed through the meter and registered as a deduction on the totalizing counter. Meters are located in a depressed section of piping to maintain flooded casings.

Each meter is protected from incoming air by a float operated vent valve. This valve passes air and relieves suction pressures across the meter to the defuel pipeline when air reaches the meter with the last portion of fuel at the end of a defueling operation.

4) *Facilities for unloading trucks*: These were designed in conjunction with the tank truck loading rack and consist of four unloading assemblies arranged in pairs, with each pair located to serve either of two truck lanes in the rack. Each pair is so located on the island between lanes that one assembly is at each end of the lane. This provides for simultaneous unloading connections to a truck and its tank trailer.

Each unloading assembly consists of a vertical riser pipe through the island slab with a swivel ell approximately 12 in. above the slab. Connected to the ell is a manual plug valve, check valve, and 12 ft of 2½ in. hose with a quick-connect coupling of the type used by tank trucks in the Seattle area. When not in use the hose assembly is centered on the island in a permanent hose rack.

The unloading assemblies are directly connected by piping to the tank fill header, with flow from trucks by gravity to the storage tanks. Tank fill valves are controlled by the central operator in the tower. An additional safety feature was provided in a high level shutoff valve operated by a float in the storage tank.

5) *Facilities for loading mobile truck refuelers*: These were designed in conjunction with the truck unloading assemblies and consist of two 4 in. loading arms mounted in the loading rack. Each arm is capable of swinging 360 deg and serves two truck lanes, being mounted on the island between lanes. Each arm is equipped with a telescopic extension to reach loading domes on trucks which may not be exactly centered in the loading lanes.

Flow from each arm is directly controlled by a loading valve capable of being operated either from atop the truck or from a platform on the island. Flow to the loading arms is directly from a refueling pump header through a pressure reducing valve to drop the pressure from the level required by the refueling hydrants. Design flow from each loading arm is 400 gpm.

Unique Fire Protection System

6) *Fixed fire protection*: This consists of a fixed system of fire protection for the facilities and, in the case of the aircraft positions, resulted in a system which is unique in concept and design. Fixed protection for the aircraft is provided by an automatic foam system, with nozzles installed in enclosures mounted on the apron paving and arranged strategically around the aircraft.

In addition to the foam system, water fog curtains are provided between positions with nozzles also set in the apron paving. Fog curtains consist of straight lines of nozzles situated midway between positions, with the lines extending the full depth of the position. Control of the foam system for any position and its adjacent water fog curtain is automatically tripped by means of a heat-actuated device mounted above the fueling hydrant and meter stations. In addition to automatic control, actuation of the individual systems can be accomplished either locally at the position or from the control tower.

Pumps and equipment and all tank truck stalls are protected by fixed water fog systems also controlled by heat-actuated devices mounted above the protected areas.

A fire at any of the four fueling positions would result in a solid blanket of foam covering the critical area of the position in approximately 60 sec. Simultaneously, a rising curtain of water fog approximately 170 ft long and reaching about 30 ft in the air would flank each side of the aircraft to preclude the spread of fire to adjacent positions.

The fueling system and other mechanical aspects of Boeing's preflight facilities were designed by Bouillon, Griffith & Christofferson, consulting engineers. The mechanical (heating, piping, and air conditioning) contractor was Wenzler & Ward Plumbing & Heating, Inc. ⋕

MADISON-EAST WING, Y-shaped structure, houses most of Baptist Memorial Hospital's major departments and 450 beds. Building is air conditioned year 'round, using chilled water for cooling and hot water for heating. Future plans call for construction of another Y section to rear of center area

Hospital's Air Conditioning Maintenance Program Guarantees Optimum Operation

Keeping a large air conditioning system, such as is installed at Memphis' Baptist Memorial Hospital, in top working condition is a big job — so much so that the institution employs an engineering and maintenance department of 73 men for this purpose. The author — in describing the operation of the system serving the hospital's recently constructed Madison-East wing and in presenting performance and operating and maintenance cost data — shows how such a program might be set up to guarantee optimum system performance.

BY DANIEL M. ROOP, P.E.
Administrative Engineer
Baptist Memorial Hospital
Memphis, Tenn.

WHEN the original Baptist Memorial Hospital, Memphis, was completed back in 1912 it was hailed as one of the most modern 100 bed hospitals in the South. This precedent set, the years have seen these high standards upheld and the hospital grow until today it has well over 875 beds and is valued at more than $23 million.

A major step in this expansion was the 1955 completion of the Madison-East wing, built at a cost of $8¼ million. The invested cost in the mechanical plant of $1¼ million included provision for a complete year 'round air conditioning system using chilled water for cooling and hot water for heating.

A single duct, high velocity system, it features complete control on a zone and individual room basis, with remote operation of the plant from a central control room.

The wing houses most of the hospital's major departments, including

450 patient beds, 96 of which are semi-private and the remainder private. On the ground floor are located the central dietary department, central sterile supply, general service areas, and mechanical equipment (exclusive of the primary air handling units which are located in a loft between the third and fourth floors).

The first floor contains a restaurant, gift shop, and administrative and business offices. Second floor space is equally divided between the pathology and radiology departments, and the third floor is the surgical suite which is made up of 19 operating rooms.

The central core on the fourth through 12 floors — all patient areas — comprises a prayer room, waiting room, elevators, and service corridors.

The air conditioning system utilizes a single duct, high velocity primary air system and a combination of high velocity air supply with low velocity air distribution for the internal or secondary systems. The primary system includes the main high velocity intake units for patient areas, administrative offices, x-ray and laboratory departments, and other service areas.

Keep File of All Equipment

To keep this equipment in top working condition at all times, the hospital employs 73 men in its engineering and maintenance department.

A formal preventive maintenance program is established whereby all records of equipment are kept in a card file system. Also, a maintenance schedule is posted on each piece of equipment. Notations are made on these cards by service men on completion of regularly scheduled maintenance procedures.

These schedules form the backbone of the program and are aided by a schedule blackboard on which records of cleanings for each of the 549 console units making up the primary system are kept. Referring to the chart, the service man can determine his day's working schedule at a glance.

These room units are high maintenance cost items in that their coils must be cleaned at least once every 30 days. Cleaning them, together with regular maintenance to other types of filters used in the primary and secondary systems, necessitates the services of two full time and one part time maintenance helpers. A 1½ hp industrial vacuum cleaner is used to clean the coils.

Currently a study is being carried on to determine the feasibility of cutting out the deflectors on the faces of these units and inserting lint screens. The cost for this work would be approximately $3000 for the entire building; however, it can be seen from the amount expended each month (about $500) for the cleanings of the console units alone that this would pay for itself within a very short time.

900 Ton Cooling Capacity

Refrigeration equipment, totaling 900 tons of cooling capacity, consists of three centrifugal two-stage compressors of standard design. These use low pressure refrigerant No. 11.

Two of the compressors are rated 300 hp with electric drive and are each capable of developing about 362 tons of cooling capacity. Each can chill 700 gpm of water from 52 to 42 F, with 900 gpm condenser water of 85 to 97.7 at 32.9 F saturated suction, and 105.3 F condensing temperature, at a maximum speed of 6210 rpm.

A third compressor, steam turbine driven, has a developed capacity of 176 tons, chilling 400 gpm of water from 51.7 to 42 F with 486 gpm condenser water from 87 to 97.8 F at 33.6 F saturated suction, and 104.8 F condensing temperature, with a maximum speed of 7272 rpm.

All three compressors have variable speed control and are under constant supervision from the central control room.

The steam turbine is operated at 125 psig and zero F superheat at the turbine throttle. Exhaust pressure is 26 in. Hg. The condenser is complete with a multi-stage air injector, inner and after condensers, condensate pump with electric motor drive, atmospheric relief valve, and copper expansion joints.

The condenser supply is in series with this compressor. When supplied with 680 gpm of water entering at 96 F, the condenser has sufficient capacity to produce an exhaust pressure of 26 in. Hg for the turbine. Water pressure drop through the condenser does not exceed 5 psig. Water pressure in the turbine does not exceed 16 psi per hp.

Controls Operate Pneumatically

The control system serving the building is of the pneumatic type, with air provided by two air compressors. These units supply compressed air to a main distribution system at 125 psig. This pressure is reduced to 40 psig at the various

TABLE 1 — PERFORMANCE CHARACTERISTICS of each of four primary unit high velocity fans which distribute air to primary or patient room system are as follows

Fan	Air flow rate, cfm	Wheel diam, in.	Static pressure, in. WG	Hp	Zone
1	11,100	27	6	20	East
2	11,500	27	6	20	West
3	10,800	27	6	20	North
4	32,000	16	4	5	Interior

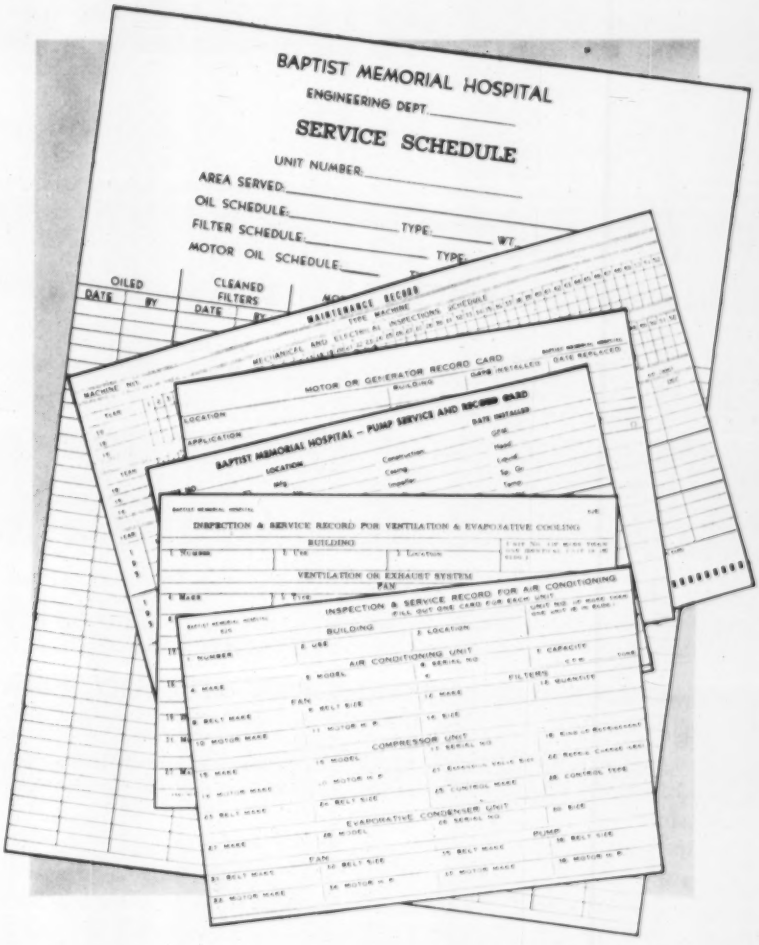
TABLE 2 — HEATING, COOLING COIL capacities for each of four primary air handling units serving primary system are as listed here

Unit	Preheat coil capacity, Btu per hr	Cooling coil capacity, Btu per hr	Reheat coil capacity, Btu per hr	Water heater capacity, Btu per hr	Zone
1	775,000	1,220,000	575,000	150,000	East
2	782,000	1,265,000	596,000	150,000	West
3	735,000	1,190,000	560,000	150,000	North
4	218,000	352,000	166,000	50,000	Interior

main equipment floors and then further reduced to 7 to 20 psig, depending on the design conditions of the particular control units. These compressors provide control air for the entire plant, operating about 50 percent of the time.

All pumps are of the single-stage, horizontally split casing, double suction type, and are designed to operate at a total head pressure of 89 psig. All motors have dripproof construction, are rated at 208 volts at 60 cycles, and have three-phase operation. They are connected to the pump drives by flexible couplings.

The two cooling towers located on the roof are of wood construction with two cells each. A connecting flume equalizes the flow between all four cells. Tower fans are 96 in. in diameter and are driven by two-speed, 10 hp motors with low and high speeds of 860 and 1740 rpm, respectively.



CARD FILE SYSTEM is backbone of formal preventive maintenance program. Inspection and service records are kept for each piece of equipment according to its type. Service schedule card (bottom of pile) is posted on equipment itself for notations by service man that maintenance procedures have been completed

Primary System Has 4 Zones

On the cooling cycle, chilled water flow is from the primary air handling unit coils (bypassing the steam heated converters used in heating the hot water during the heating cycle) and through the secondary system comprising the low pressure internal zone air handling units and the units in patient rooms and other areas.

Four primary air handling units feed a four-zone, completely automatically controlled system. Both internal and external sensing elements adjust for temperature changes in these zones as required. The changeover from summer to winter operation, however, is by manual position switches.

Operating conditions for the cooling cycle are set up so that units receiving primary air have an entering water temperature of 50 F and a leaving water temperature of 58 F. Maximum coil face velocity is 450 fpm and maximum fan outlet velocity is 1400 fpm.

On the heating cycle, water is supplied to the units at 140 F, with primary air entering at 60 F. Steam on the coils is provided at 2 psi. The maximum water pressure drop through these coils is the same as for the cooling system.

The following operating conditions are experienced when the summer design outside temperatures are 98 F dry bulb and 80 F wet bulb, respectively, and when the winter design temperature is 5 F DB: surgery areas, 74 F DB and 63 F WB both summer and winter; all other outside areas, 78 F DB and 65 F WB in summer, and 74 F DB in winter.

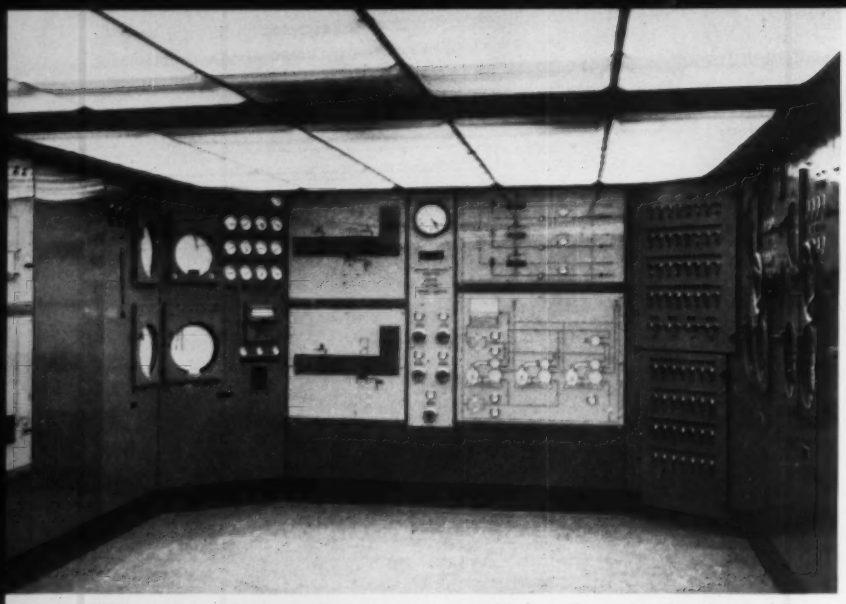
As stated previously, all air handling equipment is located in a mechanical loft between the third and fourth floors. The primary air handling units have washable mechanical filter cells. Periodically, these are manually removed and cleaned in a specially constructed filter cleaner erected by the hospital maintenance division. The unit comprises the cleaner and dishwashing machines connected with a single continuous canopy.

Four primary unit high velocity fans distribute air to primary or patient room system. The performance characteristics of these fans are given in Table 1.

These air handling units have preheat, cooling, and reheat coils. Their capacities are listed in Table 2.

Provide 14 F deg Differential

Actual conditions and temperatures required by various types of patients require a 14 F deg temperature differential from 70 to 84 F.



CENTRAL PLANT air conditioning system in Madison-East wing is controlled from this portion of remotely located central control center which regulates operation of mechanical equipment in all of hospital's buildings. To left and right of clock are graphic representations of primary air handling units, condenser and chilled water flow, steam heated converters for hot water heating, compressor and tower flow

Although the system was basically not designed for such a differential, it is accomplished by increasing the temperature of the discharge air from the preheat coil.

To do this requires operating the refrigeration compressors for longer periods than would have been anticipated under design conditions. However, this extravagance is outweighed by the importance of patients' needs. Desired temperatures within this range are controlled by individual room thermostats.

Use 10 Percent Outdoor Air

Conditioned air to each room served by the primary system is delivered through a console type of induction coil unit. As stated earlier there are 549 of these units. High velocity air is fed through and attenuated within the unit itself. Only 10 percent outdoor air is admitted, the remainder being recirculated.

High velocity air, delivered by primary fan No. 4, is supplied to the internal zone air handling units. The remainder of the air is recirculated through a return air grille in the door. This unit handles cooling to the nurses station units, center corridor areas, and other service areas on each patient floor. Two such units per floor serve two separate internal zones.

The 19 surgery rooms are conditioned by five units. These average 220,000 Btu per hr cooling load, 2200 cfm air handling capacity, 140,500 Btu per hr preheat coil capacity, and 75,000 Btu per hr spray coil capacity. They are equipped with electrostatic cell filters and mechanical rotating oil bath filters. None of these are ahead of the preheat coils.

Temperature and humidity conditions in each individual operating room are controlled by reheat coils in the ducts. These coils are set to operate at 2 psi steam pressure with air entering at 50 F DB at a maximum coil face velocity of 600 fpm. The air flow rate varies from 295 to 950 cfm to provide a heating capacity of 20,000 to 45,000 Btu per hr.

In addition to the system feeding the primary and secondary systems, 43 other air handling units of conventional design with chilled water cooling coils and steam heating coils serve the central sterile supply, restaurant, gift shop, barber shop, beauty shop, and other auxiliary services supporting hospital operations.

TABLE 3 — OPERATING COSTS for hospitals' central plant air conditioning, averaged for the period January 1 through June 30, 1956, are as follows

Item	Avg. cost per month
Electric power	
Two 300 hp motors	$ 2,188.30
Fans, pumps, etc.	631.85
Steam	2,001.78
Water	218.38
Water treatment	55.00
Lubrication	25.00
Operators' salaries (including supervision)	2,113.49
Maintenance	160.41
Depreciation (25 years)	5,370.56
Total monthly cost	$ 10,764.75
Projected annual cost	$129,177.00
Cost per ton per month (900 tons)	$ 11.96

29½ Miles of Piping

The entire system consists of 29½ miles of piping and 5.7 miles of ductwork. The pipe is hard copper tubing, except for the condenser water lines which are galvanized Schedule 40 steel.

Chemical treatment is supplied through a pressure feed system for both the internal and external systems. Chemical analyses of the water from both are made every 8 hours.

Control Center Cuts Overhead

By means of the central control center, the entire Madison-East system, together with two other central plants (a total of nearly 2400 tons of cooling capacity over a three city block area), can be started, stopped, controlled, and adjusted from a central point.

This installation has effected major economies and has enabled the hospital to operate all three of its central plants with eight fewer operators than would have been required without it. It has also permitted the operating crews to be reduced from two men per shift to only one during two of the three 8 hour shifts. Therefore it is estimated that this control room will pay for itself in salary savings alone in less than 30 months.

The Madison-East mechanical system was designed by Allen & Hoshall, consulting engineers. The mechanical (heating, piping, and air conditioning) contractor was Brown-Olds Co., Inc. Walk C. Jones and Walk C. Jones, Jr. were the architects, in association with Samuel Hanneford & Sons. ≠

NDHA HEARS HOW . . .

- ***leaks in condensate lines can be detected***
- ***rented controls improve operation***
- ***maintenance costs can be cut***
- ***use of steam for air conditioning is increasing***
- ***sales can be boosted through cost comparisons***

. . . among other subjects reported at recent meeting

BY JOHN F. COLLINS, JR.
Secretary-Treasurer
National District Heating Association

TECHNICAL COMMITTEES of the National District Heating Association reported the results of their studies and research on many phases of district heating at the recent meeting of the association at French Lick, Ind. (A previous report on the meeting appeared in the August issue.)

A review of statistics in coal sampling was presented by A. O. Blatter, chief chemist, Union Electric Co., St. Louis, as the first of three papers included in the program of the steam station engineering committee headed by Edwin C. Cawrse, general superintendent of the steam power division of Cleveland Electric Illuminating Co.

Mr. Blatter, in introducing his subject, pointed out that coal cost is the largest single operating expense of steam generating stations, and therefore the analysis of coal becomes an important commercial factor—something which cannot be made without proper sampling procedures. He said that sampling and analysis cost, however, must be kept at a minimum. Standardization and better sampling equipment are needed.

Investigate Flyash Disposal

The committee's second paper, prepared by Thomas C. Bishop, chief engineer of Cities Heating Co., London, Ontario, Canada, and dominion president of the Institute of Power Engineers, discussed flyash reinjection into boiler furnaces.

He predicted that the market for flyash will expand, but for the forseeable future a great deal of attention will have to be given to the disposal of the material for which there is no market.

Reviewing the research that has taken place on reinjection, Mr. Bishop came to the conclusion that this art has advanced considerably in the past 10 years and that its popularity as a means of disposal of flyash is likely to increase.

The final paper on the steam station committee program, by George A. Hendrickson and David O. Foltz, the latter being supervisor of heating plants of The Detroit Edison Co., went into the economic considerations leading to the installation of an additional boiler and topping turbine at the company's Beacon St. plant. As a result of studies, it was decided that a boiler be installed with a capacity of 500,000 lb of steam per hr, with stokers for coal burning. It is to be designed for 900 psig to enable operation of a byproduct power or topping turbine.

Detecting and Locating Leaks in Buried Condensate Return Lines, the first of three papers of the research committee of which Robert H. Swoyer, mechanical research engineer, Pennsylvania Power & Light Co., Allentown, is chairman, was presented to the group by Dr. S. F. Whirl, chemical operating engineer for Duquesne Light Co. and its subsidiary, Allegheny County Steam Heating Co., Pittsburgh. The paper is a companion to one presented by the same author two years ago on the subject of leaks in buried steam lines.

Cite Leak Detection Methods

From 48 replies to a questionnaire sent out by Dr. Whirl to steam utilities, he learned that 13 have condensate return systems and, therefore, are quite interested in leak detection. From the questionnaires, from inquiries to other pipe line industries, and from a search through existing literature, he determined that there are several methods of leak detection, but only two which seem practical.

One is the water column method. A section of line between manholes where a leak is suspected and where the line slope is known is isolated from the rest of the line. A water column is connected at the lower end of the isolated section, and the pipe filled with water which then also partially fills the column. As water leaks from the section, the water level in the column drops. When the water level in the pipe gets down to the leak it stops and the water level in the column becomes stationary, thereby showing the approximate location.

The other is the radioisotope method. A slug of radioactive iodine, sodium, or similar material is passed through the suspected section of pipe. This is then thoroughly flushed out so that no radiant material remains in the line. However, some radioactive contamination has occurred in the soil at the point of the leak. A Geiger counter is used to locate this point.

Inflating a rubber bladder at various locations in a leaking section of line is another detection method. A pressure gage indication that there is a pressure drop in the line is evidence that the inflated bladder is in a position beyond the leak.

Other less effective methods for district heating make use of steam and thermocouples, dyes, odor, water hammer, and sound instruments. Dr. Whirl also indicated that additional simple procedures are needed.

Report Corrosion Studies

J. K. Rice, of Cyrus William Rice & Co., Pittsburgh water chemists, in his article, *Rotogenerative Corrosion Current Detection in Corrosion Studies*, reviewed the method of studying corrosion by measuring the local corrosion cell-currents using a rotating specimen and a probe electrode. He discussed the results of various investigators using these methods and suggested possible future studies.

Compare HTW, Steam

In his paper, *Operating Experiences with Large High Temperature Water Central Heating Systems*, Paul L. Geiringer, president of American Hydrotherm Corp., which operates high temperature water district heating systems at a number of major military airports, described these systems, told of their operation and maintenance, and compared them with steam systems. He defined high temperature water as being water above 220 F—usually between 400 and 450 F.

Mr. Geiringer said that these systems are of two types: the direct forced circulation boiler system and the direct contact-heater steam boiler system.

He claimed that fuel consumption is reduced 20 to 25 percent in high temperature water systems over fuel consumption in equivalent steam systems because:

1) The radiation losses in the lines are lower for several reasons

2) Flashout losses and actual condensate water losses are eliminated by the closed water system

3) Blowdown losses are eliminated.

Cost Comparisons Boost Sales

Presenting the opening paper on the sales development program, sponsored by committee chairman James C. Thompson, Georgia Power Co., Atlanta, Arthur T. Lukens, supervisor of sales applications for Philadelphia Electric Co., related the successful methods used by his company to estimate steam requirements and make analyses of competitive costs to obtain an increasing amount of steam business.

Mr. Lukens said that a mere estimate of the cost of steam service may be all that is required to close the sale if conditions within the prospect's facilities are unfavorable for private plant operation—worn out boilers, lack of space for stack and plant equipment, labor trouble. However, if a new building is being contemplated or if selling conditions are less favorable, a cost estimate of private plant operation may be necessary, including labor cost, maintenance expense, and fixed charges such as interest, depreciation, insurance, and taxes, he added. Mr. Lukens described the process of making these estimates.

Scold Low Load Factors

Robert L. Fitzgerald, president of the Duluth Steam Corp. and a veteran of many years' experience in the district steam business, in his paper, *Selling Steam on an Interruptable Basis as a Method for Improving Annual Steam Load Factors*, called the very low load factors, varying from 26.25 in Atlanta to 31.5 in Duluth, "the curse of the district heating business."

To increase the total amount of annual profitable steam output as compared to the output which would be possible if the capital plant were able to work at capacity for the entire year, Mr. Fitzgerald suggested use of the interruptable service contract such as is used by gas companies. The available excess capacity over and above heating requirements is sold to heating customers who can use it to the advantage of both parties in the spring and fall, and to strictly industrial customers who can use it all year but can afford to switch to another fuel when necessary. Annual gas load factors of almost 90 percent are thus attained, he said.

Mr. Fitzgerald also drew attention to the practice of the electric industry of charging high rates to low load factor customers, and vice versa.

Steam utilities, he said, unfortunately are not usually located in industrial districts, but instead in commercial or apartment house areas. He recommended that steam utilities search there diligently for off-peak business, such as a few have found in institutions having boiler plants in good repair where it has proved to

be of economic advantage to use their own plants on peak loads and to purchase steam at other times at low off-peak rates.

Rent Out Heating Controls

In the first of three papers furnished by the commercial relations committee, headed by Carl W. Signor, The Detroit Edison Co., Frank C. Meyer, head of the steam sales and service division of the Boston Edison Co., disclosed his company's practice of renting to its customers certain types of space heating controls—a custom which began in the depression years.

At present, while all customers may rent the equipment, the idea is promoted only where buildings are inadequately staffed with personnel qualified to operate and adjust controls. Usually, only company personnel have access to rented equipment for adjustment. Only three reasonably priced models of the many available are provided because of the necessity of stocking parts, he said.

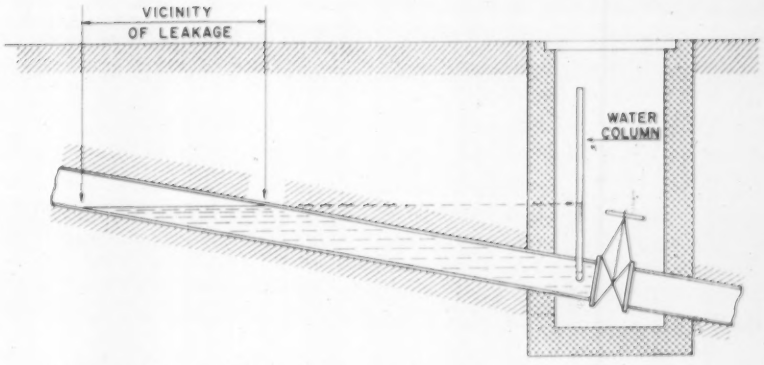
Mr. Meyer stated that his company reduces its system pressure of something over 100 psi to 40 psi for customers, and requires that they install 250 psi pilot type, single seated, dead end service pressure regulators arranged to shut off steam when actuated by an intermittent control.

He further reported on a few two-pressure control installations which modulate distribution pressures in two-pipe orificed steam heating systems, which he said are more efficient and do a better regulating job than the usual intermittent type of control and approach the efficiency of expensive complete modulating control installations.

Compare Operation in 2 Motels

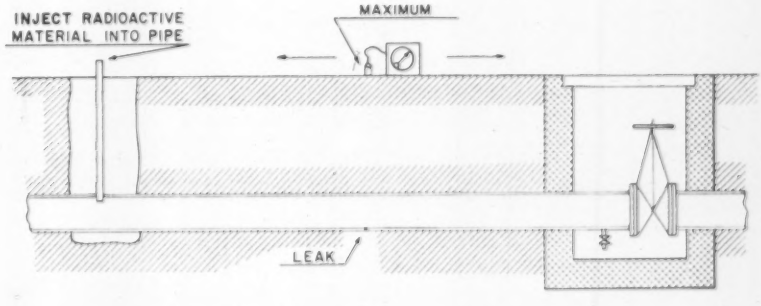
Two papers were presented on the same program by Carl B. Sprenger, supervising engineer, customers' steam service department, The Detroit Edison Co. One discussed motel heating, and the other railroad Pullman and mail car heating.

Three new motels and one in the planning stage are now or will pur-



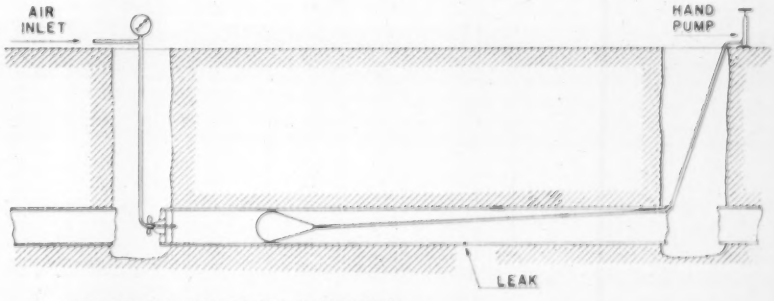
1. ISOLATE PIPING BETWEEN MANHOLES.
2. INSTALL WATER COLUMN AND FILL LINE WITH WATER.
3. MEASURE HEIGHT OF WATER IN COLUMN.
4. KNOWING SLOPE OF LINE CALCULATE POINT OF LEAKAGE.

ONE WAY to locate leaks in condensate returns is water column method. Water level in column corresponds to level of point in line slope where leak is located



1. INJECT RADIOACTIVE MATERIAL INTO PIPE.
2. FLUSH WATER THROUGH PIPING TO REMOVE MATERIAL.
3. USE GEIGER COUNTER TO LOCATE AREA OF MAXIMUM RADIATION.

ANOTHER WAY, the radioisotope method, detects leak by locating contaminated soil using Geiger counter



1. ISOLATE LEAKING SECTION IF POSSIBLE.
2. SNAKE AN AIR HOSE THROUGH THE SECTION.
3. CONNECT AIR BLADDER TO END OF HOSE AND INFLATE WITH HAND PUMP.
4. APPLY AIR TO SECTION FROM FIXED END, WATCHING GAUGE FOR PRESSURE DROP.
5. DEFLATE AND MOVE AIR BLADDER A NOMINAL DISTANCE AND REPEAT TEST. A PRESSURE DROP INDICATES THE LEAKING AREA.

THIRD METHOD uses inflated rubber bladder. Pressure drop in line is evidence that bladder is in a position beyond leak

chase steam from the company, he reported. The first of the completed motels has a steam absorption chiller to provide summer comfort and a circulating hot water system for the heating season. The other two have convectors rated at 15,800 Btu per hr each.

In these motels, steam entering the basement under the office area is reduced to 7 psi. A copper steam main, starting at 3 in. and ending at 1 in., rises to the furred space above the first floor ceiling. From this main ⅜ in. copper tubes feed the convectors in the upper and lower floor rooms. The return line below the concrete floor is separated from it by 6 in. of sand.

Heaters are placed in the partitions between bedrooms and baths so as to serve both. Maids set the temperature at 55 F each morning. It takes only 10 to 15 minutes to raise the temperature when occupancy is expected.

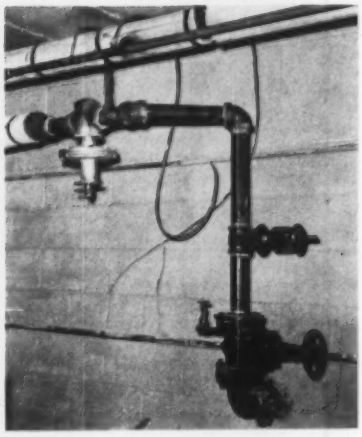
The steam consumption for these motels is listed below:

	Motel No. 1	Motel No. 2
Heated volume, cu ft	151,520	128,570
Rental units (plus office)	65	45
Steam use		
Lb per deg day	203	175
Lb per deg day per 1000 cu ft	1.34	1.36
Lb per deg day per rental unit	3.12	3.89
Lb per day for water heating	...	642
Lb per rental unit for water heating	...	14.3

Mr. Sprenger said that the motel-hotel in the planning stage will have 125 sleeping rooms, plus meeting rooms and dining rooms. It will be both heated in the heating seasons and air conditioned in the summer months by purchased steam.

Study Ways to Cut Maintenance

For a number of years the steam service operation department of the Consolidated Edison Co. of New York, Inc. has been experimenting with tetrafluoroethylene to reduce maintenance costs of customer service equipment. Charles C. Brown, superintendent of the department, made a report on the success of these experiments. He said that the producer of this chemical compound provides it in powdered form to licensed manufacturers who fabricate it into tape, sheets, rods, and tubes.



STEAM at 7 psi is conveyed by ⅜ in. copper tubing to convectors for heating new motel. Shown are utility owned steam valve (bottom), motel's valve and pressure regulator

Other rings having been tried without satisfaction as seats for packless spindles for flow meters, seats of tetrafluoroethylene were successfully used and accepted as standard by the utility, with the result that the annual number of spindles changed was reduced from more than 1100 in 1948 to 65 in 1957.

In another experiment in 1955 the material in shredded form with a synthetic carbon binder was molded into rings and successfully tried as packing on pressure reducing valves. The company maintains 4000 such valves in sizes from 1 to 8 in. on customers' premises. Packing of these valves has been reduced from about 3000 annually to approximately 900.

The manufacturer of the product claims that its properties can be modified by the addition of various fillers to make it suitable for many uses.

30 Psi Warms Idle Coaches

In the second of his papers, Mr. Sprenger disclosed the demonstrations of The Detroit Edison Co. at the Union Depot in Detroit, proving that passenger coaches and Pullmans standing on tracks can be kept warm by steam at 30 psi. Originally, the customer had thought that 100 psi would be needed.

Along a 6 in. metered supply line parallel with the track, steam connections are at 525 ft intervals so that five cars can be heated from each supply point. It is customary to keep standing cars at 55 to 60 F until almost time for train departure, then raise their temperature.

On test with 10 F outdoors, a pressure of 34 psi on the first of eight cars being heated after 10 minutes produced a pressure of 15 psi at the end car, he reported.

Mr. Sprenger said that the average and maximum steam uses per car-hour per year were respectively 144 and 200 lb.

Report Progress of Summer Use

In New York City more progress has been made than anywhere else in the U.S. in the use of district steam in summer for air conditioning, stated Robert D. Martin, general manager of steam service operations of the Consolidated Edison Co. of New York, Inc. In recent years Mr. Martin has been chairman of the NDHA air conditioning committee.

The extent of its air conditioning business made engineers of the steam service operations department of Consolidated Edison keenly aware of the desirability of having a summer steam use criterion similar to the degree day so useful in heating calculations. Progress in this direction was disclosed by John J. Drummond of the company.

He said that the best correlation of load and output with temperature was obtained by using the arithmetic average of dry and wet bulb temperatures; other factors such as solar radiation and wind movement not being considered because of the work involved. The base was established at 57.5 F.

The installation of a steam absorption air conditioning system in a 27 year old Boston office building, how the postwar expansion of universities has increased steam consumption, how meter bearing failures can be prevented, and how corrosion to underground steel encased steam mains can be controlled will be discussed in another article in an early issue. ≠

INDUSTRIAL VENTILATION:

How Are Built-up Systems Designed?

The design of a built-up industrial ventilation system requires very judicious selection of equipment. In the August issue the author stressed the care which should be taken by the designer in choosing equipment locations, in selecting the right inlet types, and in designing casings to be sturdily built with all compartments accessible. He continues here, discussing the proper applications of dampers, the factors in choosing filters, and the importance of freeze protection to air heaters.

JOHN H. CLARKE
Engineering Design Supervisor
Air Conditioning and Power
Visking Co.
Div. of Union Carbide Corp.

AFTER having chosen the system location, specified the types of inlets, and designed the system casing, the next consideration in the design of a built-up industrial ventilation system is the selection of outside, return, and bypass dampers.

In most cases it is desirable to provide outside air dampers which will close automatically on fan shutdown. However, for systems that admit 100 percent outside air and operate continuously, such dampers are not too important. In case of emergency shutdown in cold weather they are convenient in providing more comfortable working conditions. Dampers may also be required for shutoff because of fire requirements or, on those systems for which freezestats have been provided, to stop the fan on low temperature. Not all systems should be provided with such shutdown. If safety requires that the system continue to operate, a low temperature alarm may be preferable.

As mentioned in the August article, where the system inlet is located in a wall, the outside air dampers may be set to open to a maximum of 45 deg and can serve as combined weather louvers and shutoff dampers. See Fig. 4b on the next page.

Where the internal air is reasonably clean, some industrial supply systems that operate on 100 percent outside air in the summer to provide heat relief may recirculate air in the winter. In such cases the outside air may be reduced to the minimum required for makeup, process, and hoods, and the rest of the air recirculated. This saves on heating load and, with proper design, reduces the possibility of freezing.

To minimize freezing it is necessary that the outside air and the return air be mixed thoroughly. Otherwise, the cold air may stratify and freeze a heater section, even though the average mixed air temperature is well above freezing. To accomplish good mixing, the outside and return air should enter the casing 90 deg apart in direction, and the two columns should impinge upon each other.

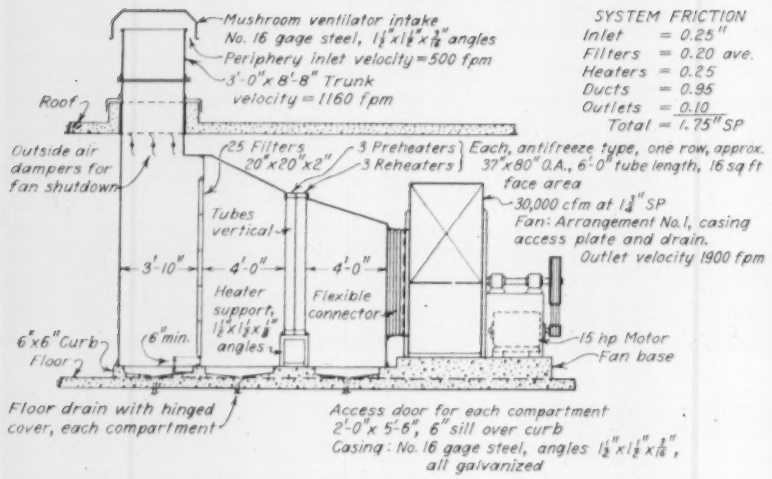
If possible, it would be desirable for the return air to enter on each side of the casing and the outside air at the end. The return air should never enter the casing above and parallel to the cold outside air. The dampers should open in such a way that the outside and return air columns will impinge upon each other at all opening positions, as shown in Fig. 4a. The use of opposed dampers will give equally good results. It should be kept in mind that the outside air damper and inlet should be sized for the full system capacity.

Personally, I do not like face and bypass control of system temperatures because I believe a well designed control valve system is less complex and will provide safe and superior control — particularly in mild weather when overheating is difficult to avoid. However, many engineers prefer this system because of the freeze protection it provides. When used, it is essential that the bypass area be kept small enough so that the volume passed with the dampers open will approximate the volume through the air heaters with the bypass dampers closed.

It should be understood that with the bypass and face dampers in mid position the system will deliver an excess of air. The amount of excess will depend upon the percent of reduction in system pressure which takes place. Low pressure systems will be affected to a considerable extent.

The bypass damper arrangement should provide good air flow into the fan inlets. Opposed dampers may be necessary for this purpose. The best air flow conditions will be provided where it is possible to locate the bypass section in the center of the system casing, either horizontally or vertically, between the air heaters. All fans are sensi-

The author is a member of the technical advisory committee on industrial environment of the American Society of Heating and Air-Conditioning Engineers. He has written several articles for Heating, Piping & Air Conditioning on the various aspects of design, operation, and maintenance of heating, ventilating, and air conditioning equipment and systems in industrial plants.



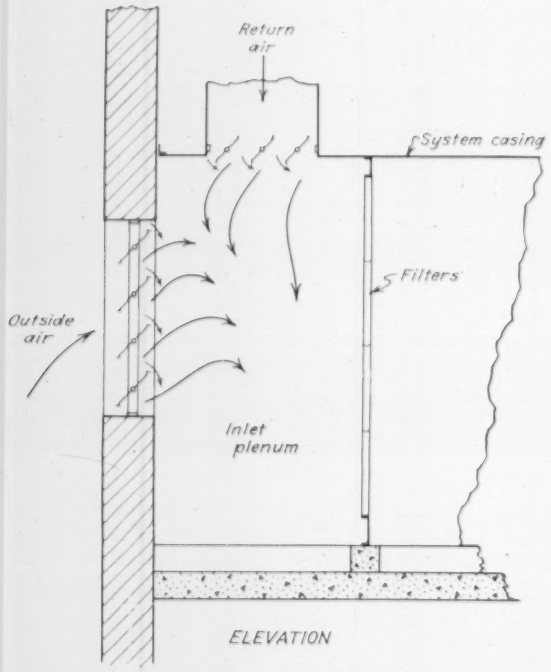
1 TYPICAL well designed and constructed system casing would have outside air dampers, filters, preheaters, reheaters installed as shown. Careful selection, proper application, tight installation of these components are critical to system performance

tive to poor inlet flow conditions. This is particularly true of vaneaxial and backwardly inclined centrifugal fans.

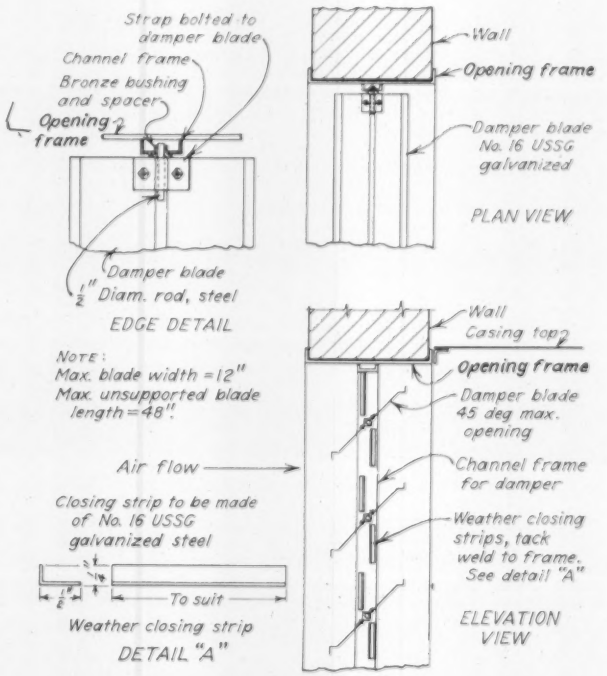
Dampers Should Have Rugged Construction

The dampers should be ruggedly constructed. Some construction details are shown in Fig. 4b. The damper assemblies should be made up in channel frames and should be reinforced at the corners, so as to permit them to be installed as a unit, including intermediate supports. It should be noted that the maximum blade width is 12 in., that the maximum unsupported length is 48 in., and that bronze bushings are provided for bearings. The blades should be crimped, as shown, for rigidity.

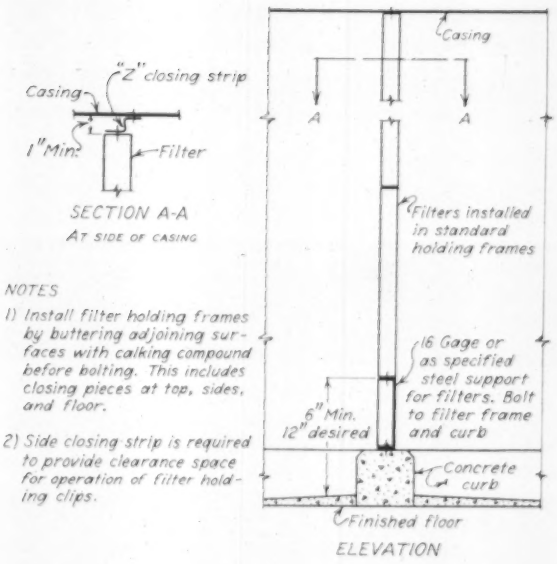
Air flow and friction through the damper sections should be based on the net clear area. For weather dampers which open to a maximum of 45 deg, the net area, depending upon the number of dampers, may be considerably under 70 percent of the gross area because of the restrictions at the top and bottom blades. This is also true for fixed weather louvers where blades are set at 45 deg. Blade "hooks" to prevent water blow-through further reduce the effective inlet area. It is always wise to check the net area of such dampers to be sure it is adequate.



4a DAMPERS should open such that outside and return air columns will impinge on each other at all opening positions. Thorough mixing of outside and return air is necessary to minimize danger of freezing caused by stratification. (Figs. 2 and 3 were in the August issue)



4b RUGGED CONSTRUCTION is a must for dampers. Assemblies should be made up in channel frames, should be reinforced at corners so they can be installed as a unit, including intermediate supports. Blades should be crimped for rigidity


Casing
"Z" closing strip
Casing
1" Min.
Filter
SECTION A-A
AT SIDE OF CASING
NOTES
1) Install filter holding frames by buttering adjoining surfaces with calking compound before bolting. This includes closing pieces at top, sides, and floor.
2) Side closing strip is required to provide clearance space for operation of filter holding clips.
Casing
A
A
Filters installed in standard holding frames
16 Gage or as specified steel support for filters. Bolt to filter frame and curb
6" Min. 12" desired
Concrete curb
Finished floor
ELEVATION

5 CELL TYPE IMPINGEMENT FILTERS are common in industrial ventilation systems. Installation features include adequate "sill" to allow heavy dirt particles to drop to floor without clogging bottoms of filters. Where inlet is from above, filters should be set back about 1 ft to provide better air distribution

Ordinarily the inlet velocity for the system should be about 1000 fpm based upon *net effective inlet area.*

Select Filters for Job to Be Done

The selection of air filters is subject to a great variety of opinion among engineers. The important thing is that the filter should fit the job. I believe that there are very few systems where it is practical to omit the filters, and a system with a heavy dirt load that requires frequent filter cleaning — two to four weeks — is not one of the exceptions.

Without filters, the heaters and duct system must be cleaned frequently and it is difficult to avoid damage to the heaters in the process. The filters selected should give the user good efficiency and ease of maintenance. One factor in the latter is uniformity in the type and size of filter, within practical limits. This reduces spares and makes maintenance easier and less costly.

High efficiency filters such as the electrostatic type should be used only for systems serving areas which require very clean atmospheres — pharmaceutical manufacturing, precision assembly operations, and many electrical manufacturing applications. Such filters are expensive in initial cost and to maintain and can only be justified if they are installed properly, are maintained, and if the area housekeeping is of as good a quality as the filters. It has been estimated that 50 percent of the dirt that gets into a building with ordinary filtration is brought in by the personnel on their shoes and clothing. So it is a practical impossibility to keep an area anywhere near dust free unless the interior is kept spotlessly clean and, in many cases, unless the employees wear special clothing.

Wherever high efficiency filters are used, the incoming air should be prefiltered to permit them to do their work without excessive loading caused by heavy dirt, lint, snow, and airborne vegetable matter. Plate type electrostatic filters should be provided with afterfilters in many applications to catch "blowoff" in case of power failure. The electrostatic filters should be selected for servicing in place. Filter compartment floor drains are essential parts of the installation.

Many systems are provided with cell type impingement filters. I prefer the permanent, metal type in the 20 × 20 × 2 in. size, shown in Fig. 1. Properly maintained, these filters will give good efficiency. Details of this installation are shown in Fig. 5. An adequate "sill" is desirable to allow heavy dirt particles to drop to the floor without clogging the bottoms of the filters. Where the inlet to the system is from above, it is desirable to set the filters back from the entrance plenum about a foot to provide better air distribution over them.

It is very important that the filters be firmly secured in their holding frames to prevent air leakage around them. This usually requires a good spring or lever action catch. Side slide-in filter arrangements are not desirable because they cannot provide a reasonably airtight arrangement. As previously mentioned, the filter frames, joints, and casing should be made as tight as possible to prevent dirt from bypassing the filters. Such dirt leakage can reach appreciable quantities.

The face velocities used for the filters for design purposes should be obtained from the manufacturer for each specific type.

Design Air Heaters For Freeze Protection

The air heaters and their installation should be carefully designed for freeze protection, regardless of whether the system operates on 100 percent outside air or with partial recirculation in the winter. The exception would be a system providing complete year 'round air conditioning where about 80 percent of the air is recirculated and where there are no fumes in adjacent areas that might require system operation at 100 percent outside air to "flush out" the area in an emergency.

For freeze protection, the air *preheaters*, at least, should be of the inner distributing tube (antifreeze) type. Most designers feel that it is desirable that *both* the preheaters *and* the reheaters should be of the antifreeze type for added protection. It should be clearly understood that the use of these heaters cannot of themselves *prevent* freezing. They do, however, definitely reduce this possibility and, combined with proper installation and design of the piping system (not within the scope of this article) and operation, the possibility of freezing is remote.

For industrial supply air applications the heater tubes and fins should be of copper. In some cases, the less expensive aluminum fins on copper tubes may be used, but these can cause corrosion problems in some industrial atmospheres and so the practicability of their use should be carefully explored. Trouble is usually encountered in sys-

tems that are humidified (sprays or steam) or where the heaters are exposed to high humidity in the summer. To reduce the corrosion possibilities it is often desirable to specify copper tubes and fins that are tin or lead dipped.

With the possible exception of one manufacturer who provides a downward slope for both the supply and return tubes within the heater casing, the return bend type of heater should never be used for makeup air service. Return bend heaters are subject to water hammer unless they are exactly level and, with few exceptions, are not furnished with inner distributing tubes. While plain tubes are tenable with face and bypass control where the steam control valve is wide open at freezing temperatures, most engineers definitely prefer the added protection of the inner tube.

For heavy loads, high velocities, low steam pressure, and particularly where the heaters are installed with the tubes horizontal, consideration should be given to antifreeze heaters having 1 in. OD tubes in lieu of the usual $\frac{5}{8}$ or $\frac{3}{4}$ in. OD size. These heaters can clear much higher starting-up condensate loads because of the increased clearance between the inner and outer tubes. This is another way of reducing the possibility of freezing. The higher cost of these heaters may be well worthwhile.

The heaters should be of the header type with the supply and condensate headers either at the same or opposite ends. Preferably, the heaters should be installed with the tubes vertical, because this reduces the possibility of freezing by positive drainage. Many designers feel that heaters installed vertically and having the steam and condensate headers at the same end give the best protection because the steam is fed from the bottom and protects the cold end of the heater. My preference is for an "opposite ends" heater with the steam supply at the top and assisting in driving the condensate out of the heater. Properly designed and installed, either arrangement will give good service and freeze protection. With the vertical tube installation, stratification through double inlet or multiple fan installations will be definitely reduced. The tube length for vertical air heaters handling air below freezing should not exceed 8 ft, and 7 ft would be preferable.

Where air heaters are installed horizontally, their tubes should be pitched at least $\frac{1}{4}$ in. per ft for good drainage. Some manufacturers pitch the tubes within the heater frame so that no further pitch is necessary.

The heater can be installed with the headers at either the same or opposite ends. The tube length for horizontal heaters should not exceed 7 ft, preferably 6 ft. For very large systems, in order to maintain this limit, it is advantageous to use heaters with headers at the same ends and to install them end-to-end with the piping connections on each side of the system casing. This arrangement will also aid greatly in reducing stratification where multiple fans or double inlet fans are used.

Avoid Oversizing Air Heaters

Oversizing is another factor which contributes to freezing and causes overheating problems in mild weather. To prevent oversizing, air heaters should be selected for the required temperature rise at the face velocity selected and for the steam pressure at the heater. No safety factor should be added other than a 10 percent allowance in temperature rise to compensate for dirty fins in service.

For the usual heating requirements, a single row preheater followed by a single row reheater is sufficient. The single row preheater is necessary in order to be sure that the heater elements are well loaded. In colder climates where additional capacity is required, a second row should be added to the reheater, not the preheater. Otherwise the preheater will be vulnerable to freezing when operating at just below 32 F on throttling control. On face and bypass control, the heater steam valves should be wide open at 32 F, but the preheater should still be single row to reduce overheating at mild temperatures.

For systems which operate on more than 50 percent recirculated air in the winter and do not require emergency "flush-out" capacity, the preheater (tempering heater, in this case) is usually ample. If desired for some additional capacity, a 4 fin per in. reheater could be provided.

Face velocities (velocities based on *gross exposed* tube areas) are usually selected between 600 and 700 fpm for heaters handling 100 percent outside air. Where air is recirculated so that the mixed air temperature is near or above freezing, velocities of 1000 fpm are quite acceptable. If the higher velocities are used with all outside air the temperature rise will be low and the condensate rate may exceed the limits for the heater. Under such design conditions, proceed with caution.

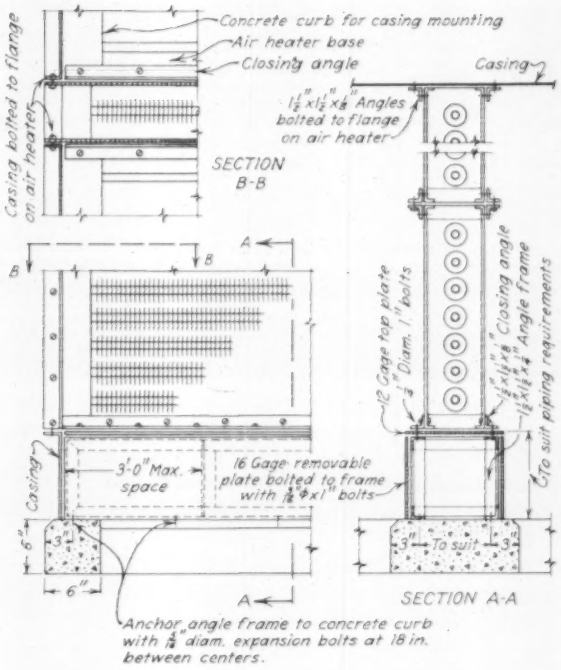
The aforementioned design procedures will reduce the possibility of air heater freezing. The piping and control design are extremely important in providing freeze protection. Space does not permit exploring such details in this article. It should suffice to say that anything that will hold condensate in a heater or cause a very low steam feed under freezing temperatures will be likely to cause freezing and freeze damage.

How an Air Heater Is Chosen

A typical heater selection might be based on the following conditions:

Specified air flow rate, cfm	=	30,000 (100 percent outside)
Outside design temperature, F	=	−10
Final air temperature, F	=	70
Temperature rise, F deg	=	80
Steam pressure at heater, psig	=	2 to 5
Face velocity, fpm	=	600 to 700

For these conditions an antifreeze type, one row, 8 fin per in. preheater operating at 650 fpm face velocity and 5 psig steam pressure at the heater (following the control valve) would have a catalog temperature rise of 59 F (from −10 to 49 F). Allowing a 10 percent deduction for dirty fins, this would provide a final temperature for design purposes of 43 F. The reheater could be the same as the preheater except for 6 fins per in. This would provide a catalog temperature rise of 39 F (from 43 to 82 F). With a 10 percent dirty fin deduction this would provide a



6 AIR HEATER installation details shown above. Horizontal heaters are shown, but details are similar for vertical ones, the piping being connected through heater support. Angles are used for bolting one heater to another. For horizontal heaters, angles help in sliding one heater in or out over another. For usual installation, preheaters and reheaters are bolted together, back-to-back. Construction details are otherwise the same

final temperature of 78 F, which is ample for the prescribed conditions. For colder climates or higher final air temperatures an 8 fin per in. reheater should be used. For warmer areas, 4 fins per in. may be ample. Where 50 percent or more air is recirculated the reheater can be eliminated as previously mentioned.

For the above air heaters the design steam load (and control valve capacity requirement) would be about 1780 lb per hr for the preheater, heating from −10 to 43 F. The reheater load would be 910 lb per hr, heating from 43 to 70 F. For the preheater it would be well to size the control valve for the clean heater condition (−10 to 49 F) or 1990 lb per hr of steam.

In considering the final air temperatures required in industrial areas it should be kept in mind that many of these areas require "cooling" all year long (supply air enters at lower than room temperatures). Consequently, final temperatures of 60 to 70 F or lower may be ample even in sub-zero weather. Where the supply air is carefully mixed with warm internal air, even lower supply air temperatures are possible with a resultant saving in steam load.

Details for installing the air heaters are shown in Fig. 6. Horizontal heaters are shown, but the details are similar for vertical ones. In the latter case, the piping is connected through the heater support. One closing plate is bolted on to permit this, and the top plate of the support is provided with openings at the heater connections.

In Fig. 6 angles are shown for bolting the one heater to the other. Closing plates of 16 gage steel are just as acceptable and are better for vertical heaters. For horizontal heaters the angles, as shown, help in sliding one heater into place over another during construction or if a heater is removed for repair.

The heater connections are simplified if they are external to the system casing, as shown, so that it is not necessary to penetrate the casing except for piping under the heater support (vertical heaters only). The support space is blanked off from the air stream. When the heaters are completely inside the casing, piping penetrations should be carefully sealed with insulation and closing plates to prevent air leakage. It is usually desirable to insulate the casing to and including the heaters to prevent condensation. The insulation over the heater headers will also stop air leakage into the system casing. Some air heaters are poorly sealed at the headers and permit excessive air leakage.

Don't Abuse Heater by Misapplication

One last precaution: Many industrial plant operators, maintenance men, and engineers (who should know better) seem to be intrigued with the idea that in the summertime the air heaters can do double duty by providing cooling if well, lake, or city water is circulated through them. If the heaters were *capable* of passing a large quantity of water, some *small* benefit might be obtained in lowered discharge air temperature for the system. But these heaters have small orifices which are designed for steam flow. Therefore they will permit a relatively small amount of water to be circulated, particularly in a manner that would promote heat transfer.

The water will leave deposits which will damage the heater and materially affect its capacity for heating. If cooling is desired and justified, provide a cooling coil which is designed for this purpose — instead of damaging an expensive air heater to the extent that it is useless for either heating *or* cooling.

The next article on built-up industrial ventilation systems will discuss the proper design and application of fans and electrical equipment. ⊣

References

Summer-Winter Comfort Ventilation for Industry, by B. R. Small, Industrial Ventilation Symposium, ASHAE Journal Section, Heating, Piping & Air Conditioning, February 1957, pp. 241-246.

Are You Getting Good Returns from Your Ventilating Investment?, by Dr. A. D. Brandt, Iron & Steel Engineer, September 1956, pp. 92-100.

Industrial Ventilation — A Manual of Recommended Practice, published by American Conference of Governmental Industrial Hygienists.

Why Steam Coils Freeze, by H. W. Alyea, Heating, Piping & Air Conditioning, April 1958, pp. 104-107, and May 1958, pp. 127-129.

Advanced Approach Simplifies Piping Flexibility Analysis

. . . *for process and power piping systems*

BY EDWIN A. WERT
Engineering & Construction Div.
Southwestern Engineering Co.
Engineers and Constructors

SINCE piping constitutes the main arteries in modern petroleum refineries and chemical and power plants, it is a major item in the cost of these plants—frequently as high as 35 percent of the total installed equipment cost. In fact, the high operating temperature and pressure conditions in a steam transfer line for a recently completed power plant resulted in a unit cost of $1000 per ft of pipe erected.

These high costs, plus the trend toward high temperature-pressure conditions and process applications involving the flow of corrosive fluids, have increased the need for advanced piping technologies.

Many advances in piping practice have been made since the American Standard Code for Pressure Piping B-31 was first issued back in 1935. Today's code, B-31. 1-1955, is still growing and being changed to keep abreast of new developments. The present task force or sectional committee, as well as the different coordinating committees on piping problems, has great responsibility, and its contributions are of immense value to the industry as well as to the individual designer in his respective field.

For the process and power industries the selection of piping materials and the design of piping for flexibility can become extremely involved. Corrosion, erosion, and contamination must also be considered. Long runs of pipe headers are subject to uncontrollable environments, and present problems requiring design dexterity.

Criteria for design include temperatures in the 1000 F range with relatively high operating pressures. Process industry piping is subject to corrosion which makes the design of such piping more complicated than that of the power industry. To obtain dimensional stability, corrosion resistance, and freedom from graphitization, alloy steels are usually substituted for carbon steel to meet these more stringent requirements. It is an axiom of design that the final selection of material must be based on design considerations which include environment.

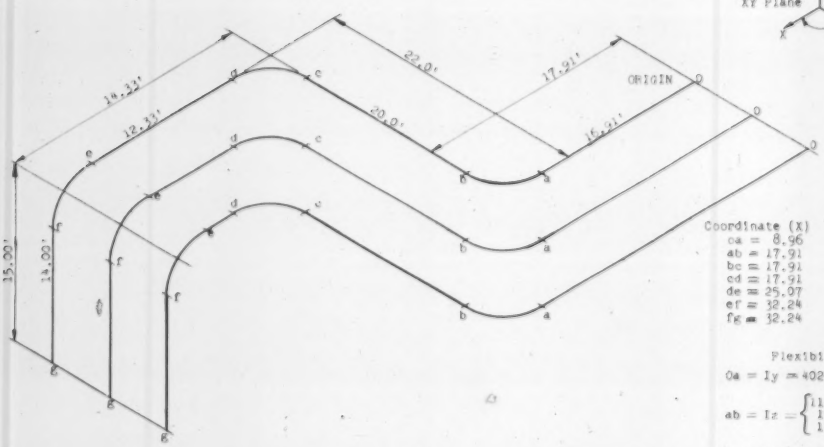
The operating experiences of the oil refinery and chemical process industries have contributed greatly in creating the background of steels for the power industry. Today's high operating pressures and temperatures in the

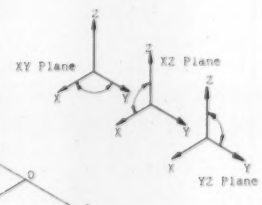
NOTE: ④ and ⑧ Fig. 3
Total coordinate distance from point of origin of coordinate systems to the centroid of each individual element. (Welding fittings and quarter bends, use centerline of axis)

TOTAL DEFLECTION CONSTANT

$\Sigma I\Delta X = 0.97687(1,216,695) = 1,188,553$
$\Sigma I\Delta Y = 0.57500(1,216,695) = 694,124$
$\Sigma I\Delta Z = -0.55300(1,215,595) = -672,832$

Problem
8.625 inches O.D. Pipe, R = 12 inches. ASME - A-53
Operating temperature 422° F, e = 3.03 in./100 ft.
Schedule 40.





Coordinate (X)	Coordinate (Y)	Coordinate (Z)
oa = 8.96	oa = 0	oa = 0
ab = 17.91	ab = 0	ab = 0
bc = 17.91	bc = 11	bc = 0
cd = 17.91	cd = 22	cd = 0
de = 25.07	de = 22	de = 0
ef = 32.24	ef = 22	ef = 0
fg = 32.24	fg = 22	fg = 7.50

XY PLANE
Flexibility coefficients for tabulation form.

oa = Iy = 402.2 = $L^3/12$ or I own of the element. ⑦

ab = Iz = $\begin{Bmatrix} 11.60 \\ 1.11 \\ 1.03 \end{Bmatrix}$ = Bend in Plane of Projection. ③⑥⑦⑩

bc = Ix = 667 = $L^3/12$ or I own of the element. ⑥

cd = Iz = $\begin{Bmatrix} 11.60 \\ 1.11 \\ 1.03 \end{Bmatrix}$ = Bend in Plane of Projection. ③⑥⑦⑩

de = Iy = 156 = $L^3/12$ or I own of the element. ⑦

ef = Iy = $\begin{matrix} 1.81 \\ .17 \end{matrix}$ = Bend out of Plane of Projection. ③⑦

fg = 1.3(1)=18.20 = (Poisons ratio) Increased Flexibility. ③

1 ISOMETRIC DRAWING with data showing typical pipe line in space for hand or desk calculation. Both ends are considered as anchored with added external movement. Point of origin is indicated. Physical dimensions, coordinate values, flexibility coefficients are shown for bending in the *XY* plane only. Similar forms are required for data covering the *XZ* and *YZ* planes

. . . using the "algebraic method" —

LONG RADIUS WELD - ELBOWS

8.625			Bend in Plane Of Projection			Bend out of Plane of Projection		Radius 12"		
Dshed. No.	X	1	Kl (3)	I OWN (6)	I PROD OWN (7) 10	Kl (9)	I To Axis 10	I	I	A
20	9.65	2.90	15.15	1.44	1.35	1.81	0.17	57.7	13.39	968,321
30	8.64	2.71	13.56	1.30	1.21	1.81	0.17	63.4	14.69	1,062,300
40	7.37	2.44	11.60	1.11	1.05	1.81	0.17	72.5	16.81	1,216,695
60	5.73	2.06	9.00	0.86	.80	1.81	0.17	88.8	20.58	1,490,241
80	4.53	1.76	7.10	0.68	.63	1.81	0.17	105.7	24.52	1,773,857
100	3.74	1.55	5.87	0.56	.52	1.81	0.17	121.4	28.14	2,037,534
120	3.00	1.34	4.71	0.45	.42	1.81	0.17	140.6	32.60	2,359,548
140	2.58	1.21	4.05	0.39	.36	1.81	0.17	153.7	35.63	2,581,071
160	2.26	1.11	3.55	0.34	.32	1.81	0.17	165.9	38.48	2,784,133

EXPLANATION OF THE COEFFICIENTS OF THE UNKNOWNS FOR TABULAR FORM USE.

A — Deflection Constant

$= \frac{\Delta(EI)}{4728} = \Delta X, Y$ or Z (A)

BEND IN PLANE OF PROJECTION

(3) Kl = Length of piping element (virtual length)

kl = 1.57(R)R, Where R is in feet. K = Flexibility Constant $= \frac{1.65}{h}$ for welding elbows.

(6) I OWN = $\pi(.149R^3)$

(7) I PROD OWN = $\pi(.157R^3)$

BEND OUT OF PLANE OF PROJECTION

(9) Kl = 1.81R, where R is in feet.

(10) I ⊥ To Axis = $1.15(.149R^3)$

Fig. 2

COEFFICIENTS FOR PIPE STRESS ANALYSIS USING TABULATION FORMS

XY PLANE

(2) and (5) Coefficients of the Unknowns (SHAPE CONSTANTS) VIRTUAL LENGTHS.

(4) and (8) Total coordinate distances.

(5) and (9) Static Moment - Product of element.

(6) and (7) Moment of Inertia of the Segments.

(10) Product of Inertia.

(1) M E M	(2) l	(3) kl	(4) K	(5) kl$_x$	(6) In kl$_y^2$	(7) Ip kl$_x^2$	(8) I	(9) kl$_y$	(10) I^{xy} kl$_{xy}$
						400,220			
oa	16.91	16.91	8.26	151.52	0 0	2,357.53	0 0	0 0	0 0
					1.11	1.11			1.05
ab	11.60	11.60	17.91	207.76	0 0	3,720.38	0 0	0 0	0 0
					567.20				
bc	20.00	20.00	17.91	358.20	2,420.00	9,415.56	11.00	220.00	5,240.00
					1.11	1.11			1.05
cd	11.60	11.60	17.91	207.76	5,612.00	3,720.38	22.00	255.20	4,570.32
						150.00			
de	12.55	12.55	25.07	309.11	5,907.72	7,749.58	22.00	271.00	6,800.42
						147			
ef	1.81	1.81	50.24	98.56	876.04	1,881.20	22.00	39.82	1,795.70
		x1.5							
fg	16.00	16.20	50.24	986.27	8,908.80	28,917.44	22.00	800.80	12,368.64
SUMMATION	90.45		1872.40		24,551.89	84,525.48		1150.82	29,500.04

SUMMATIONS OF INTEGRATIONS BECOME THE GENERAL EQUATIONS.

NOTE: TO CHECK RESULTS PROCEED AS FOLLOWS:

(5) x (7) / (10) = (10)

Member 5e = (5,907.72 x 7,749.58)/ 5,800.42 = 5,800.42

Fig. 3

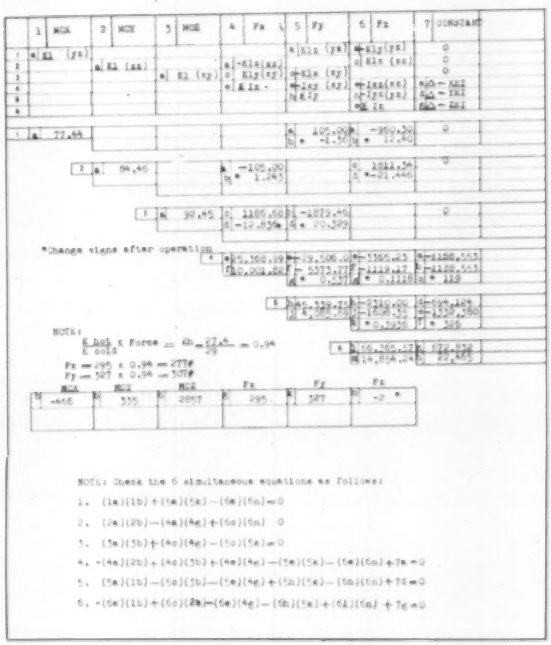


Fig. 4

MOMENTS

Mox	2857	Fx	295	Fz	-527	
Moz	-466	Fy	527	Fx	2	
Moy	555	Fz	-2	Fy	-295	0 Point of origin

MOMENT	Y	22	X	17.91	5490	Mx	Mx 3500 ft. lb.	
AT	Z	0	Y	22	-422	Mz	Mz 297 ft. lb.	
POINT oa	X	17.91	Z	0	297	My		

STRESS CALCULATIONS

S_a — ALLOWABLE STRESS RANGE = 1.25 S_c + 0.25 S_h

$S_a = 1.25 \times 20,000 + 0.25 \times 17,050 = 29,262$ lb. per sq. in.

S_b — RESULTING BENDING STRESS $= \frac{Mb \times 12 \times i}{Z}$ P.S.I.

$S_b = \frac{3500 \times 12 \times 2.45}{10.01} = 6096$ lb. per sq. in.

S_t — TORSIONAL STRESS $= \frac{Mt \times 12}{2Z}$ P.S.I.

$S_t = \frac{297 \times 12}{2 \times 10.01} = 106$ lb. per sq. in.

$S_L = \sqrt{S_b^2 + 4 S_t^2} = \sqrt{6096^2 + 4 \times 106^2} = 6100$ P.S.I.

Point oa

Fig. 5

2 TABULATION form showing development of shape coefficients, or virtual length covering 8 in. OD long radius weld elbows and listing results for pipe schedule numbers

3 FORM used for listing flexibility coefficients for each member, as taken from tabular form shown in Fig. 2. Corrections for systems of varying moments of inertia and effect modification for lines in torsion are listed in this form. Similar form sheet is required for each plane

4 THIS tabulation form lists summation values of integration, as solved in Fig. 3. The six simultaneous equations as solved provide forces and moments to be listed in Fig. 5. Deflection constant permitting addition of external anchor movements is adjusted for in Column 7

5 RESULTING moments and forces at point of origin are taken from Fig. 4. Use of this form permits the establishing of moment and stress at any point in system

power plant field are also forcing the use of much thicker walled pipe of special steels of ferritic and austenitic stainless composition. In this high pressure (5000 psi), high temperature (1200 F) field, designers need to know more about the behavior of metals.

Practically all piping is considered to run between several fixed points, since it normally interconnects different pieces of equipment each of which is more or less anchored in place. In practice, these location points or anchors may be subject to movement caused by expansion, due to their distance from the point of anchorage and the temperature variations encountered within the equipment.

In refinery layouts, the designer must provide for movements in the piping systems due to the large vertical expansion of the different reactors and towers. He must also provide for the horizontal movement of heater connections due to the inner expansion of the tube system.

With the proper arrangement of piping sections, these external movements in the different planes of expansion may be made to parallel the corresponding axes of the pipe configurations. The net result would be minimum amounts of external movements due to cancelling out of thermal expansion effects. A piping system with shorter lengths, correspondingly less insulation and, in many instances, fewer hangers or supporting devices is then possible. Where it is necessary to add these external movements to the already existing pipe line movements, the reverse effect results.

In applications requiring long steam, exhaust, and hot process lines, the resulting conditions may pose a complex problem, especially in arriving at a simplified flexibility solution. If the piping layout incorporates expansion loops the designer must consider lateral movements caused by longitudinal expansion of the piping between anchors. Here, the designer may elect an optimum design expansion bend with relatively large lateral movements, or elect to permit only small lateral movements. The latter design would require a greater number of anchors, guides, and expansion bends.

A complete study of the general design problem with the correct and concise assemblage of all needed data permits the designer to solve the problem quickly and efficiently. To obtain these results, a standardized procedure is the criterion for design.

New Methods Outmode Old Flexibility Analyses

The selection of the most economically shaped pipe structures to provide for expansion and flexibility continues to be one of the most influential single design features affecting the safety and economy of a piping system. In recent years this highly scientific field has become even more technical. These scientific achievements in piping design help avoid the extravagance of oversafe "guessing" as well as the penalty of incorporating an inadequate design.

Brushing aside the masses of historical detail covering the wide choice of methods available for analyzing piping systems for correct stress with acceptable reactions, the following are methods used for arriving at modern flexibility analyses:

1) The chart solution[1,2], using graphical methods for the design of single plane pipe structures. These simplified methods fulfill an important need which, when in capable hands and with ample allowances for their limitations, will serve to provide the quick rough check important to the layout man in establishing an initial layout, therefore making the use of more refined calculations unnecessary for avoiding false starts. Also, the proper use of the forms is to obtain a systematic recording of data and work performed in making the above flexibility studies.

2) Tabular forms using the "algebraic method[3]" as described in Figs. 1 through 5. This mathematical analysis, as selected from the several published methods and from the author's experience, has proved itself to be especially suited for both simple and complex pipe stress problems up to and including three anchor problems without other limitations. The author originated the data form shown in Fig. 2. The use of this tabular form greatly speeds the entire calculation and helps materially to avoid errors which, when not located in the early stages of computation sequence, can be of major proportion in lengthening the computation time.

The simplicity of standard tabular forms shown in Figs. 1 through 5 indicates their adaptability to the speed of desk calculators. Since the simple coordinate system is independent of any elastic center, this tabular analytical method is less susceptible to error. A change of piping may be easily accommodated without complete revision of the coordinate system.

Fig. 1 indicates a recommended procedure for an orderly layout of the piping problem. The physical dimensions as well as the operating conditions of the sample problem are shown. An isometric sketch for each working plane would show the shape or flexibility coefficients. For this sample problem only the bending in the XY plane is shown in detail. The X, Y, and Z coordinate values are shown. The virtual length for each bend is obtained from Fig. 2 tables and shows the values of the in or out of plane of projection effect.

Fig. 3 lists the flexibility coefficients for each member as tabulated for the XY plane only. For the three dimensional problem it is necessary to have the additional XZ and YZ tabulation forms (eliminated for sake of brevity). From an inspection of the data listed in Fig. 3, it is seen that a cross check of the computations may be obtained as noted.

Fig. 4 shows a tabular form for receiving the summation of integrations as solved in Fig. 3. These shape coefficients form the pattern for solving a set of six simultaneous equations. (Two anchor problem.) The constant terms in Column 7 express the thermal expansion of the line and anchor movements. The simultaneous equations may be satisfied by the cross check as indicated. The forces and moments are then computed for the point of origin.

Fig. 5 is the tabular form for receiving the force and moment values computed on Fig. 4. These values are then transferred from the point of origin to the points in the system at which location the stress is required. In this example the maximum stress is at point 04 or member *cd*.

A single plane piping problem with two fixed anchors may be analyzed within a few hours using the tabular form system, as only one form similar to Fig. 3 is required.

The additional advantage gained by using the tabular form system over the chart system for single plane problems is its ability to add external movements to the anchor points. Initially, the use of the charts permits the designer to originate the shape structure. The constant term in column 7 of Fig. 4 expresses the thermal expansion of the line and the anchor movements.

For the three dimensional, two anchor pipe line with approximately eight members there would be required seven tabular forms permitting the solving of six simultaneous equations. The time required to complete the stress analysis (point of maximum stress) is from six to eight hours.

For the three branch anchor problem resulting in 12 simultaneous equations, nearly 80 hours would be required for the aforementioned desk calculator analysis.

Another article, to be published in an early issue, will discuss the use of the high speed electronic computer in pipe stress analysis. ≠

References

[1]*Design of Piping for Flexibility with Flex-Anal Charts*, by E. A. Wert and S. Smith, Blaw Knox Co.

[2]*The Detroit Edison Engineers Present Graphs for Design of Piping for Flexibility*, by E. A. Wert and S. Smith, Heating, Piping & Air Conditioning, August 1933.

[3]Meyer-Hovgaard, Journal of the American Society of Naval Engineers, November 1941.

SAM LEWIS SAYS...

"I Changed Pump Connections to Solve Hot Water Heating Problem, Save Fuel"

I WAS CALLED to see an unhappy patient. Here was a big hot water boiler with automatic firing of the fuel. The large office building which it served had four orientations and five separate air supply systems. There were 10 different water circulating systems, each with a separate electric pump.

Each pump created suction to develop sub-atmospheric pressure in the returning water pipe, and all of them discharged the water into this single heater. Thus, the temperature of the water in the heater constantly was being reduced by the introduction of all of the water that the pumps could handle.

I prescribed that the pump connections should be changed so that each pump would circulate the water of its own zone independently. A bypass was to be arranged under thermostatic control so that if the water in any one of the circuits came back at a temperature cool enough to be-stir the thermostat, a portion of the high temperature water from the boiler would enter the circuit.

After we made these changes, the water in the circuits that required the least heat was found to recirculate for hours without any injection of hot water from the boiler. This change brought about a corresponding reduction in fuel consumption.

A valuable tool is an automatic thermostat placed outdoors and dedicated to the service of approximate or average temperature control for a fuel burner. In a dwelling with many small rooms it may not be expedient to install a separate thermostat with a separate adjustment of dampers or valves for each room. In such a case an outdoor thermostat may adjust the indoor temperature to be warmer as the outdoor temperature decreases, and to be cooler as the outdoor temperature rises.

This scheme fails dismally, however, when one attempts to achieve results by having the outdoor thermostat control the delivery of heat by radiators on the pertinent side or orientation of the building. The outdoor thermostat has no way of knowing whether the indoor temperature on that orientation is being influenced by some ventilating system or by heat created by occupants and electric lights.

A safer recourse, if one wishes to employ an outdoor thermostat, is to permit it to regulate the fire in the boiler in inverse proportion to weather changes, and to control the indoor temperature by a thermostat in each room.

It is wise, if one must employ a thermostat, that said thermostat have control over all possible sources of heat that *can* be controlled. An outdoor thermostat controlling the radiators assuredly will enter disastrous conflict with an indoor thermostat that controls the temperature of the air delivered to a room or zone. ≠

SAMUEL R. LEWIS, *consulting mechanical engineer and a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors, comments informally each month on practical problems in the field.*

Combination of Several Systems

BY JOHN G. SKIDMORE
Partner
Gussow and Skidmore
Consulting Engineers

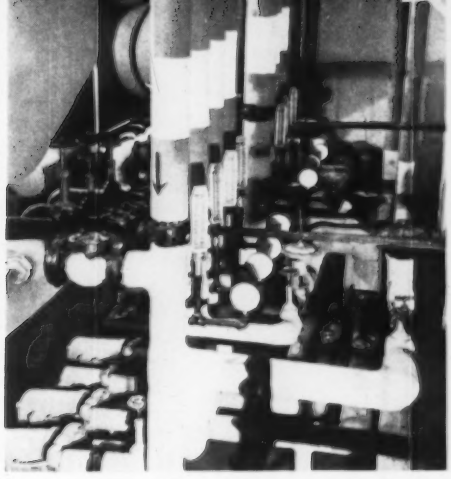
GRID PIPE COILS in ceiling convey hot water to effect radiant heating to floor below. System serves 75 percent of school's total area, including library, shown. Each pipe is manually vented at return header end. Supply headers run along outside wall; returns are in corridors

A COMBINATION of several types of heating systems is employed in the new Half Hollow Hills High School, Long Island, N. Y. to suit the unusual physical requirements of the school.

The school building consists essentially of 24 classrooms, four science rooms, two homemaking rooms, two shops, two art rooms, two music rooms, a gymnasium with boys' and girls' locker rooms, a 550 seat auditorium, a library, a lunchroom with kitchen, and an administration area —all designed for 945 students.

The building's architecture presented problems in the selection of the type of heating system. The use of exposed fluted steel roof decking as a finished ceiling and floor-to-ceiling glass in the outside walls precluded the use of floor mounted unit ventilators or convectors. The extended plan of the building ruled against forced warm air for reasons of economy. Floor panel radiant heating would not respond to rapid changes in heating requirements of classrooms due to the thermal lag of the floor slab.

NEW HIGH SCHOOL'S exposed fluted steel roof deck ceiling, floor-to-ceiling glass outside walls, extended floor plan, and thermal lag of floor slab made impractical the use of any single method of heating. So various media—hot water, warm air, unit heaters, radiant panels—are used to serve the needs of different areas



SEVEN CIRCULATING PUMPS serve like number of building zone areas; two for radiant floor panels, five for other heating and ventilating media

Solves School's Heating Riddle

It was therefore decided that the heating system be tailored around these problems, and that the most practical method of heating be employed to suit each area.

Install Ceiling Pipe Coils

The system designed for the classroom area, which comprises about 75 percent of the total floor area of 103,563 sq ft, consists of ceiling pipe coils fabricated of 1 in. steel pipe 12 in. on centers in grid form, with both supply and return headers below the plane of the grid pipes.

Each grid pipe is manually vented at the return header end. Supply headers run along the outside walls, and return headers are in the corridors.

The pipes are supported by the roof bar joists in the flutes of the ribbed steel roof deck; the piping and underside of the roof deck being exposed to view.

Cut Fabrication Costs

The grid coils were fabricated and placed on the bar joists before the roof was installed, thereby eliminating costly field fabrication.

The effect of a radiant ceiling is obtained from the lower portion of the grid pipes and from the ceiling warmed by radiation from the upper portion of the grid pipes and some convection in the roof deck flutes. The location of the pipes in the flutes (the bottom line being in the same plane as the bottom of the roof deck ribs) restricts convection currents largely to the volume of the flutes, thereby convecting heat to the roof deck where it is radiated to the space below.

The heating medium is forced hot water. This is supplied from two automatically fired cast iron boilers using unheated No. 5 fuel oil. Chimney height is kept to a minimum through the use of an induced draft fan.

How Other Areas Are Heated

The auditorium and cafeteria are heated and ventilated by forced warm air systems, and the kitchen by unit heaters. The gymnasium is heated by radiant piping laid between the concrete subfloor and the hardwood floor; supply ventilation is by means of ceiling mounted fan-coil units.

The administrative wing, including the auditorium lobby and music rooms, is heated by radiant panels installed in the floor.

Seven zone circulating pumps in the boiler room serve a like number of building zone areas. Two pumps serve the area heated by radiant floor panels, with local recirculating pumps and three-way valves. Five pumps serve the ceiling pipe coils, supply ventilation units, and unit heaters.

These five pumps are equipped with automatically controlled bypasses to maintain constant discharge pressure against the throttling of local automatic two-way valves.

Automatic temperature control is of the pneumatic type, with hot water delivery temperature varied inversely with the outdoor dry bulb temperature below 65 F.

Room thermostats control two-way modulating valves on ceiling radiant coils and three-way mixing valves on floor radiant coils, hot water supply, outside air, return air, and exhaust air dampers of forced warm air systems, and fan motors of unit heaters.

The heating systems were designed by Gussow and Skidmore. The mechanical (heating, piping and air conditioning) contractor was Hassett Heating and Fuel Oil Co. The architect was Daniel Perry. ‡

Swedish Air Raid Shelter Designed for Atomic War

The possibility of an atomic attack has set new standards for the ventilation and air conditioning of underground air raid shelters. A new structure of this type has been constructed in Stockholm against just such an emergency and has capacity for 20,000 persons. In peacetime the facility is paying for itself as a public parking garage.

BY AXEL ROSELL
Axlander & Rosell
Consulting Engineers
Stockholm, Sweden

KATARINABERGET, probably the world's largest shelter constructed for protection in case of an atomic war, was completed in Stockholm, Sweden, during the summer of 1957. This underground citadel is built in rock about 100 ft below street level and stretches between two parallel streets above, running at a distance of about 1500 ft.

The shelter is designed to accommodate a maximum of 20,000 persons for a limited time, or to serve as a sleeping area for 5000. The total floor space, including entrances, is about 150,000 sq ft, the fully protected area being about 90,000 sq ft. In all, 130,000 cu yd of rock was excavated.

Cost Demands Peacetime Use

The considerable cost of a large air raid shelter makes it essential that a way be found to put the installation to some practical peacetime application which would make it pay. In this case, as it is with several similar Swedish shelters located under residential or business centers, the best proposition has been found to be its use as a public parking garage.

This is the most practical application because:

1) It requires so few extra arrangements that must be changed or removed when re-establishing the locality as a shelter, that a minimum amount of time for this changeover is needed.

2) The ventilation requirements of the structure as a garage correspond fairly well with those of its use as a shelter. This is of special importance as the air intakes and part of the air ducts are securely embedded in rock so as to be able to withstand the shock waves that may occur under wartime conditions. There is no flexibility in the installation of these devices, therefore, which would permit much of a variety of applications for the structure.

3) The garage can be kept at a relatively low temperature without inconvenience. This is important because the temperature of the rock surrounding the shelter must be kept as low as possible to provide an extra source of cooling which could be used in case of emergency.

4) A garage, well situated, is a fairly good source of rental income, in spite of the rigorous demand that must be imposed for quick evacuation at any time.

Three Floors, 800 Ft Long

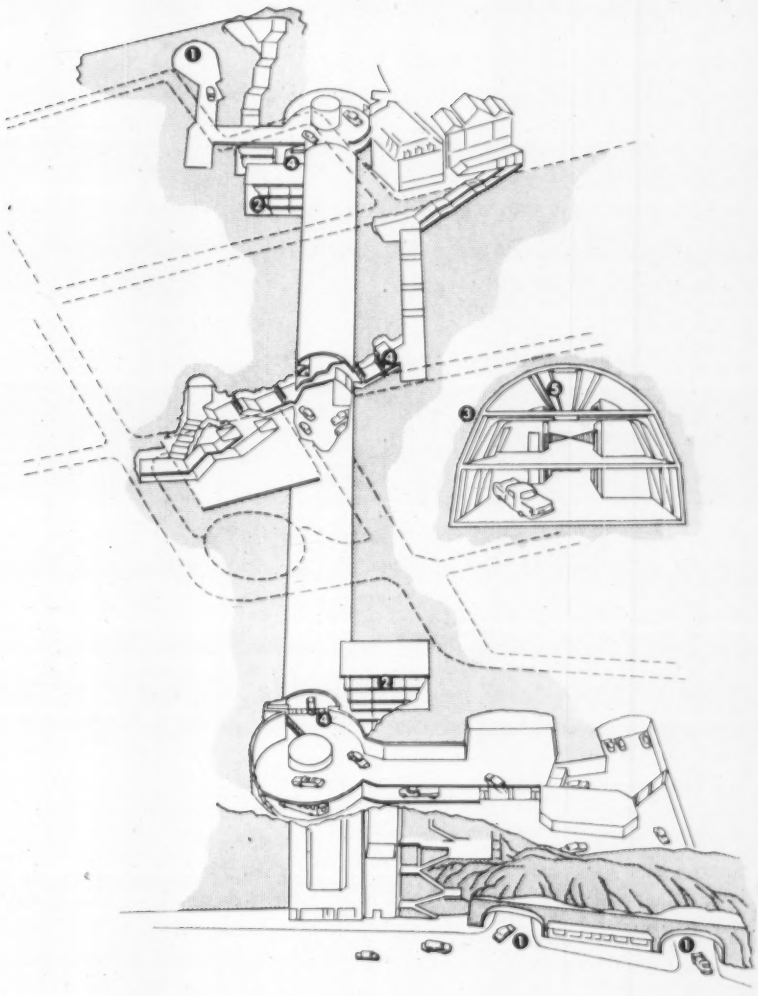
The general layout of Katarinaberget shelter is shown in Fig. 1. It contains three floors, each with a length inside the fully protected area of about 800 ft. The main entrance from one of the streets comprises a complete service station and a drive-in bank. Cars entering from this end can be driven into either of the two lower floors. Cars leaving the garage can reach either street, Katarinavagen or Tjarhovsgatan.

An elevator at each entrance permits direct accessibility to the streets over the "roof" of the garage.

The two garage entrances are also the main entrances under wartime conditions. The shelter is also accessible by three staircases.

As a garage the facility has capacity for about 550 automobiles.

Ventilation Emergency



AIR RAID SHELTER-GARAGE shown diagrammatically at right. Underground structure is about 100 ft below surface and has entrances at two parallel streets above

LEGEND

1 Entrances
2 Equipment rooms
3 Tunnel cross-section
4 Blastproof doors
5 Air distribution ducts (upper floor)

Two 4-Floor Equipment Rooms

The main air conditioning and ventilating equipment is placed in two four-floor equipment rooms, one at each end of the main tunnel.

Each equipment room contains:

1) Three supply fans; one for each floor of the main tunnel. These would be used under both peacetime and wartime conditions.

2) Three exhaust fans serving the three floors in common. These fans would also be in operation under all conditions.

3) Cooling machinery comprising two refrigeration compressors which are coupled either to direct expansion coils for cooling the supplied air or to three automatic ice making machines that deliver crushed ice into an ice water tank in the lower part of the equipment room.

4) Two series of filters; one for collecting radioactive dust, one for adsorption of poisonous gases. These filters have comparatively high resistance to air flow and are therefore connected to a set of auxiliary fans of the medium pressure type.

5) A set of diesel engine driven auxiliary generators. These are automatically put into action the moment the normal power supply fails.

6) Shock wave filters designed to prevent detonations outside the shelter from damaging the mechanical equipment.

7) A drilled well for drinking water supply with all necessary equipment.

8) Storage tanks for cooling water for the cooling machinery, diesel engines, and emergency cooling system (ice-water, in this case); drinking water; and diesel oil.

In one equipment room are also installed two oil fired hot water boilers capable of delivering a top load of 6.5 million Btu per hr. A fuel oil tank is in the lower part of this equipment room. Arrangements have been made for the use of coal or wood if oil is not available.

Chimney Design Is Unique

The chimney is almost entirely embedded within the rock. It is made of brick and has mineral wool insulation. To prevent clogging, the shock wave filter is normally bypassed. As the upper part of the chimney cannot

AIR DISTRIBUTION DUCTS are placed along center line of ceiling in upper floor main tunnel. Note sprinkler system. Changeover from peacetime to emergency conditions can be made with little alteration to system

be entirely protected, arrangements are made so that, should the chimney be demolished, most of the brick work will fall below the level where the flue gas leaving the shock wave filter enters the vertical shaft. The boiler plant will thus be able to function temporarily in spite of the destruction of the brick walls.

In peacetime, a considerable part of the heat required for garage ventilation is supplied by using the exhaust air from an electric power station situated above the tunnel. Waste oil from the service station is also used for heating purposes.

For peacetime ventilation of the entrances, service station, and bank, separate units are installed outside the fully protected area.

How Supply Air Is Distributed

Each of the main equipment rooms has a reinforced concrete outdoor air duct in the rock. This leads from an air intake at a relatively high level to a preheater designed to maintain a minimum temperature of about 45 F, and further to a shock wave filter at the machine room. Connected with the three supply fans are reheat and cooling coils.

The outdoor air quantity can be varied by recirculating part of the return air or by reducing the fan speed.

In the upper floor the distribution ducts are placed along the centerline of the ceiling. In the two lower floors these pass through openings in the concrete structure. If equal air distribution is to be attained, relatively high velocity (about 2500 fpm maximum), which calls for a relatively high pressure drop at each outlet, is necessary.

As very little air movement can be allowed in the room when it is used as a sleeping area, the pressure drop is effected by slots which permit the air to be delivered into small plenum chambers from which the air enters the room through perforated alumi num ceiling panels.

Should one of the equipment rooms be demolished, the air from the remaining one can be distributed over the entire plant. Of course, the evenness of distribution would suffer.

The exhaust plant uses the space between rock and the concrete tunnel as a duct system. Following the garage ventilating code, one-quarter of the air is exhausted close to the floor, the remainder at the ceiling. The air quantity can be varied by cutting out one or more of the fans that are working on the same system. Exhaust ducts function in a manner similar to the outdoor air ducts in case one equipment room is demolished as a result of an attack.

Alter Exhaust Setup In Wartime

When changing over to wartime conditions, part of the exhaust openings are closed, and the air is directed over other openings at the lavatory groups that were also installed at this time. Simultaneously, a system of sheet metal ducts is erected which leads from the lavatories to special exhaust fans placed at all entrances.

These fans have a total capacity 20 percent below that of the gas filter equipment. They deliver into the spaces between the gastight doors and the outer concrete doors, their purpose being to keep the air leakage moving outward past these latter doors.

During peacetime conditions, all equipment for the lavatories and their ventilation is stored inside the plant.

Combat Air Contamination

Should the outdoor air become contaminated by gas or radioactive dust, the position of a series of gastight

shutters and dampers is changed so that the air handled by the main fans is circulated inside the plant. Simultaneously, the fans belonging to the air cleaning equipment are started up, as well as the special exhaust fans at the entrances. The air cleaning equipment delivers the purified outdoor air into the main fan system for distribution.

There is, so far, no equipment installed for adding O_2 and absorbing CO_2, as, in the case of this shelter, the necessity of an entire shutoff of outdoor air is judged unlikely. Space is, however, reserved for such purposes.

For regeneration of the gas filters, arrangements have been made for reversing the air stream through these filters. During the reverse cycle the air entering the filter is passed through an electric heater where it is heated to about 160 F. It is then discharged into the outdoor air through a special steel pipe exhaust duct.

The air quantities supplied are: to the fully protected area, 80,000 cfm; service station and entrance, Katarinavagen, 27,000 cfm; entrance, Tjarhovsgatan, 12,000 cfm; air cleaning equipment, Katarinavagen, 17,500 cfm; and air cleaning equipment, Tjarhovsgatan, 9000 cfm.

The main problem of the emergency air conditioning is the removal of excess heat dissipated by the occupants. This heat quantity reaches a top figure of about 12 million Btu per hr. The design air condition in the shelter in time of emergency is 86 F, with 80 percent relative humidity.

To design a central air conditioning plant for this large, one time demand would have been impracticable. A special emergency cooling system was therefore added to the plant.

Most of the cooling capacity needed for this system is stored in two ice water tanks containing ice up to about 50 percent of their volumes, the rest being water of approximately 32 F.

These tanks are connected to a cold water piping system which feeds a number of circulation air coolers erected at every 15 ft in the ceiling of the three main tunnel floors. This system satisfies about 50 percent of the cooling load.

The rest of the load is taken care of by the refrigeration machines, serving coils in the main conditioning system; by the capacity of the surrounding rock, which is made use of by circulating air between rock and the tunnel; and also by the building structure.

When used as a sleeping shelter the tunnel also needs a certain amount of summertime cooling. This demand is easily covered by the direct expansion coils of the main system.

To keep the auxiliary power station free from contaminated air, the cooling load of the generator room can be accommodated by an air cooler coupled to the ice water system.

Water Supply Is Vital

The supply of water for all purposes is a vital point in any shelter, especially so in a shelter of Katarinaberget's size. Besides the two drinking water wells, the storage tanks earlier mentioned, and the peacetime supply of city water, cooling water can also be obtained from a nearby lake. Further, the drainage water from the entire plant can be re-used if necessary.

The whole plant, including service station and entrances, is protected by automatic sprinkling systems. A fireproof partition is erected in the middle of each garage floor, with all openings being protected by automatically closing fireproof doors. ‡

References

How Underground Workshops Are Made Livable, by Axel Rosell, Heating, Piping & Air Conditioning, March 1958, pp. 118-120.

Underground Test Chamber Provides Heat Transfer Data, Heating, Piping & Air Conditioning, March 1958, p. 121.

Success of Underground Structures Depends on Air Conditioning, by Thomas H. Urdahl, Heating, Piping & Air Conditioning, April 1958, pp. 108-111.

Steam Produced From Incinerator Gases With Variable Speed Draft Inducer

A SOLUTION to the problem of disposal of combustible wastes has been achieved by the City of West Hartford, Conn., according to L. J. Wing Mfg. Co. Wastes are burned in an incinerator which is connected by a breeching to the boiler.

The capacity of the plant is 350 tons of mixed refuse per 24 hr. The plant operates an average of 8 hr per day, 5 days per week.

Incinerator gases are pulled through the boiler by a special draft inducer on top of the boiler. The boiler has a capacity rating of 5000 lb of steam per hr.

Up to 30,000 lb per hr of flue gas is pulled through the boiler, entering at 1200 F and exhausting through the draft inducer at 520 F to the chimney. When the incinerator is not operating, a standby burner produces steam for heating.

Not only is the incinerator started and shut down daily but the load burned varies over the day according to the amount of refuse collected. Draft requirements vary.

To handle the wide variation in draft requirements, a variable speed drive with pneumatic controls is connected to the induced draft fan. Modulated operation is obtained through a speed range of 3 to 1 when incinerator gases are being handled.

For example, the inducer capacity can be varied between a design capacity of 13,500 cfm at 2.35 in. water gage, 520 F, at 1585 rpm down to 4500 cfm at 0.30 in WG, 520 F, at 528 rpm. When the oil burner is in operation, the fan runs at the lowest speed.

The installation was designed by Metcalf & Eddy, engineers. ‡

SNOW MELTING is accomplished by circulating specially compounded base heat transfer oil through pipe coils in pavement slab, shown here during construction. Pavement, 22 lanes wide, has melting facilities extending 200 ft for south bound plaza, 154 ft for north bound

New Toll Plaza Snow Melting System

Chicago's $101 million Calumet Skyway toll bridge features pavement-embedded steel piping which circulates heat transfer oil to melt snow from 22 traffic lanes

BY GORDON W. NEAL
Mechanical Design Engineer
Consoer, Townsend and Associates
Consulting Engineers

APRIL 16 marked the completion of another step in the expressway system linking the nation's two largest cities. On that day Chicago's $101 million Calumet Skyway toll bridge was opened to traffic.

The Skyway is a 7¾ mile, six lane elevated expressway which begins at the western end of the Indiana Toll Road at the Indiana-Illinois state line, follows a generally northwest course, and leads to several outlets on Chicago's South Side. The bridge itself crosses the Calumet River 128 ft above the water. The project will ultimately become a link in an expressway network serving metropolitan Chicago.

All toll collection facilities together with administrative and service headquarters are located approximately 3 miles from the state line. The toll plaza consists of a total of 22 traffic lanes, 11 in each direction.

Traffic Hazards Create Need

Toll plazas are necessarily somewhat congested because of the presence of collection equipment. This, coupled with the need for all vehicles to stop for toll payment, render the normal hazards presented by a snow or ice covered pavement even more of a problem.

For these reasons it was decided that pavement snow melting facilities be installed for each plaza.

Snow melting is accomplished by circulating heated oil through pipe coils buried in the pavement slab. Oil heating and pumping equipment is located in the boiler room of the service building.

The melted approach for the south bound plaza begins 160 ft from the centerline of the toll booths. The north bound plaza has its approach length restricted to 114 ft because of interference from a bridge structure. Due to complications arising from connecting the piping between the bridge and the adjacent roadway slab, it was not feasible to extend the snow melting area into the bridge.

Both plazas have an additional 40 ft of melted length beyond the toll booths, making total lengths of 200 ft for the south bound plaza and 154 ft for the north bound. The pavement area covered by the system totals 58,500 sq ft.

COILS are fabricated from standard weight steel pipe with welded connections. To maintain minimum pumping heads, grid coils with 1¼ in. headers and ¾ in. laterals are used wherever possible. Note use of steel chairs to support piping prior to pouring of concrete

Keeps Skyway Traffic Moving

Studies made of snowfall conditions in Chicago indicate that maintaining a pavement slab completely free from snow at all times requires a heat output potential of 368 Btu per hr per sq ft of surface, exclusive of back losses. On the other hand, only 126 Btu per hr per sq ft would be required to maintain the surface completely snowfree for 90 percent of the snowfall hours.

Since it is unlikely that all 22 lanes will be required to operate during extreme snowfall conditions, the system is designed on the basis of the 126 Btu value, and provisions are made to allow diverting the available heat into six emergency lanes—three in each direction.

Allowing 30 percent for back losses results in an input requirement of 164 Btu per hr per sq ft, or a total design snow melting load of 9,580,000 Btu per hr. This will enable the system to maintain all lanes completely free of snow most of the time. It will also permit the emergency lanes to remain snowfree under almost any snowfall conditions, since their maximum design load is only 7,470,000 Btu per hr, based on an input requirement of 478 Btu per hr per sq ft.

Use Standard Weight Steel Pipe

Snow melting coils are fabricated from standard weight steel pipe with welded connections. The system comprises over 75,000 ft of this piping. To maintain pumping heads at a minimum, grid coils with 1¼ in. headers and ¾ in. laterals are used wherever possible. Continuous coils of 1¼ in. pipe serve irregular areas.

Except for the previously mentioned emergency lanes, grid coil laterals are spaced 12 in. on centers and continuous coils 18 in. on centers. The six emergency lanes have grids spaced at 9 in. and continuous coils at 14 in. All coils are embedded in the 10 in. concrete slab so that the pipe centerline is 3½ in. below the surface.

Select Heat Transfer Oil

Two commonly used heat transfer media for snow melting applications are (1) aqueous solutions of ethylene glycol and (2) a specially compounded petroleum base heat transfer oil. Each possesses the advantage of not freezing or becoming excessively viscous over the temperature range encountered in snow melting systems.

The glycol solutions have a greater heat capacity than the oil and therefore permit the use of smaller piping and heat exchange equipment.

The oil has as its principal advantage the property of being noncorrosive. Ethylene glycol is not corrosive initially but tends to become so in service and therefore requires a rust inhibiting additive. Furthermore, the inhibitor itself eventually becomes exhausted and the solution must then be drained and replaced. Because of the relatively large size of this system, corrosion could become a major problem, either through damage to equipment and piping or through the complications presented by the necessity of replacing a medium which has become corrosive in service.

For this reason the heat transfer oil was chosen as being more suit-

able. The oil does tend to oxidize and form sludge when it is in contact with copper or copper alloys; therefore, ferrous construction was used for each major piece of equipment contacting the oil.

The oil is heated by means of two shell and tube heat exchangers using 10 psig steam as the heat source. Each exchanger is capable of carrying half the design snow melting load.

Pump Selection Complicated

Selection of the circulating pumps was complicated by the wide range of fluid conditions which could be encountered during operation. When the system is operated under full design conditions the oil temperatures are such that the viscosity is not appreciably different from that of water. Under these conditions centrifugal pumps are well suited to the purpose. On the other hand, the conditions which would exist after a prolonged shutdown during extremely cold weather could lead to sluggish response upon a call for system operation.

The higher oil viscosities encountered at subzero temperatures have the dually adverse effect of substantially increasing pipe friction and at the same time decreasing the capacity of a centrifugal pump. Furthermore, the thermal capacity of the pavement slab is so great that even under optimum operating conditions the time required to warm the slab from subzero temperatures to a point above freezing could be longer than 24 hours.

Because of this compound effect it was decided to install a controller which would place a low limit on the oil temperature and thereby permit the use of centrifugal pumps and also provide for shorter warm-up periods.

Three horizontal, split case centrifugal pumps are used for circulating the oil. Each is capable of delivering 550 gpm of oil at 145 F against a total head of 100 ft. Two pumps can carry the design load with one pump acting as a standby. Each pump is provided with a 20 hp, 1750-1150 rpm two-speed motor.

Provide for Liquid Expansion

In common with other heating systems using a liquid heat transfer medium, provisions must be made for expansion of the liquid when it is heated. The properties of the heat transfer oil present special problems in providing for this expansion. To minimize oxidation of the oil the temperature and surface area of the oil exposed to the air should both be kept as low as possible.

A 500 gal open expansion tank has been installed which is connected to the system by an extended length of uninsulated pipe. In addition, the connection between the tank and the pipe has a restricted orifice to retard thermal circulation of the oil. The expansion tank has a hollow metal float which is designed to cover the entire oil surface as a means of preventing contact between the oil and air.

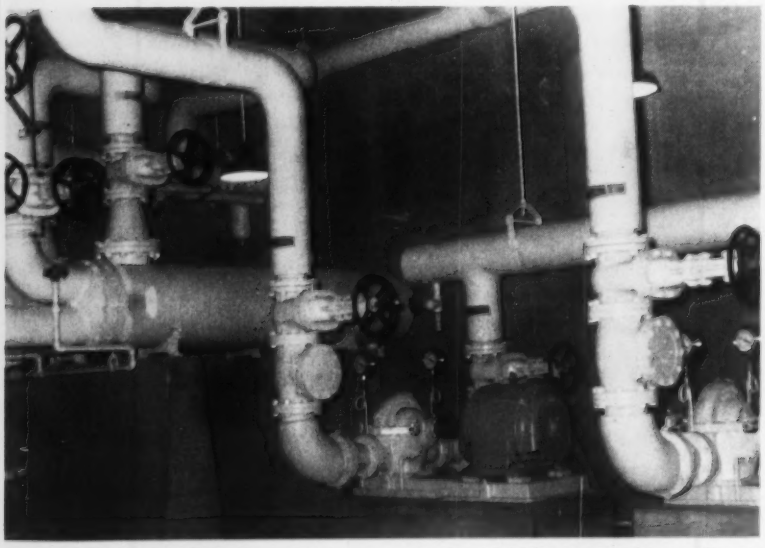
Automatic air vents are at all system high points in the oil distribution piping. Manual air vent cocks have been installed where there is a possibility of air pocketing in the pavement coils. These cocks are provided with flush cover access boxes embedded in the slab.

Arrive at Control Compromise

The objectives of the control system design were to provide, as far as possible, for a minimum of human attention, flexibility of operation, and the maintenance of low operating costs. Since one objective is often attained at the expense of another, the final system is necessarily a compromise.

Because of the high thermal capacity of the pavement slab, it is not practical for the system to operate only during periods of snowfall. A certain amount of heat must be supplied to warm the slab in anticipation of snow. On the other hand, continuous idling of the system during periods when it is not snowing and the temperature is below freezing can lead to excessive operating costs.

The primary control devices are two temperature sensing elements. These are buried in the slab at representative locations (north and south) in the snow melting areas. Other control devices are a suspended plate snow detector mounted in an open area on the roof of a ramp building, a high limit control for the heat transfer oil, and manually operated switches located in the boiler room which will open and close motorized valves in the oil sup-



CIRCULATING PUMPS, heat exchangers are located in boiler room of service building. Room houses two 200 hp, No. 6 oil fired boiler-burner units which generate 12 psig steam for heating, snow melting

ply lines to individual lanes. A strip chart provides a continuous record of slab temperatures at the sensing elements.

How Control Operates

Operational sequence of the control system is as follows:

1) *Snow not probable*: Under this condition the slab sensing elements are set to maintain a low limit slab temperature of zero F. Upon a call for heat from either element, a motorized steam valve will admit steam to the heat exchangers and one circulating pump will start on low speed.

2) *Snow possible, but not yet falling*: Operation for this condition is identical with that for (1), except that the sensing elements are set to maintain a slab temperature of 34 F. Changes of the temperature setting must be done manually on the basis of weather reports.

3) *Snow actually falling*: When enough snow has accumulated to actuate the snow detector, it will override the slab sensing elements and put two circulating pumps into high speed operation. The motorized steam valve remains under the control of the slab sensing elements.

4) *Oil temperature high limit control*: To prevent excessively high oil temperatures, a control has been included which will close the motorized steam valve in case the temperature of the oil leaving the heat exchangers exceeds 165 F. Under this condition the circulating pump continues to run.

5) *Individual lane control*: Each traffic lane, except those containing the sensing elements, has a motorized valve in its oil supply line. Manual controls for opening and closing each valve are located in the boiler room. This will permit closing the oil supply to a lane when its snow has been removed and will allow the heat gained thereby to be utilized for the remaining lanes. It will also permit all of the available heat to be channelled into the emergency lanes during extremely heavy snowfall conditions.

All temperature controls are adjustable so that the operating set point temperatures may be changed if experience indicates that this is necessary.

Determine Heating Design

The choice of the type of building space heating system was determined largely by two major requirements: snow melting and ventilation air. Direct fired units are not suitable for snow melting heat transfer media; therefore, a source of steam or hot water is required.

The nature and occupancy of the service building dictated the use of a considerable amount of ventilation air; the building is located beneath the pavement slab which results in a number of interior rooms, and a large part of the space is devoted to a garage housing vehicles operated under their own power. Since the ventilation air must be tempered in any case, the next logical step was to raise its temperature to a point where it could be used for space heating. Low pressure steam was decided upon as the primary heat source.

Space heating and snow melting are the only major components of the steam load. The space heating design load is 5,770,000 Btu per hr, computed at an outside temperature of —10 F. The 9,580,000 Btu per hr snow melting design load is computed at an outside temperature of 26 F, which is the temperature most likely to coincide with heavy snow fall.

Since the amount of water vapor the air can hold decreases as the air temperature falls, the rate at which snow can be precipitated at very low temperatures is relatively low. This, and the fact that the snow melting design load is the larger of the two, makes it likely that the peak coincident load will occur when the outside temperature is in the vicinity of 26 F. Therefore the steam generation equipment was sized on the basis of the maximum load which could be expected at that temperature — 12,289,000 Btu per hr.

Two units were selected, each of which is capable of carrying two-thirds of this load. This enables one unit to carry the total space heating design load in the event of an outage of the other.

The steam generators are both 200 hp, oil fired, package type, boiler-burner units. No. 6 oil is used as the fuel. The units are provided with an electric fuel oil heating system to maintain the oil at a suitable temperature for pumping and burning. The operation steam pressure is 12 psig.

Temper 51,000 Cfm Outside Air

A total of 51,000 cfm of outside air is required for ventilation purposes. One double-width, double-inlet centrifugal fan supplies all of this air. Exhaust is accomplished by several separate systems. All outside air is filtered by glass fiber, blanket type air filters. The filtering medium is installed on spools and is fed across the filters. The filters are automatically renewed by periodically rotating the spools in response to an electric timer.

All ventilation air is tempered to 50 F. Three heating zones are then supplied with air elevated to temperatures corresponding to the heat requirements of the particular zone. Unit heaters and fin tube radiation provide supplementary heat in exposed rooms.

Two self-contained air conditioning units supply summer cooling through a system of ducts to the office and lounge areas of the service building. The total cooling design load is 9½ tons.

The total cost of the mechanical facilities (including piping and other snow melting equipment) for the toll plazas and service building approximated $440,000. Unit cost of the snow melting system was about $3.75 per sq ft of snow melting surface.

The project was done by the City of Chicago Dept. of Public Works. Consoer, Townsend & Assoc. were the consulting engineers, with DeLeuw, Cather & Co. coordinating engineers. Chicago Conditionaire Co. installed the snow melting piping, heating, and air conditioning. Ventilation was installed by The Haines Co. ∓

Photos courtesy National Tube Div., U.S. Steel Corp. and Tube Turns, Div. of Chemetron Corp.

INSTALLATIONS SHOW HOW—

Gas Engines Drive Air Conditioning

. . . cite operating costs

How the gas engine powered system for air conditioning large buildings is used is shown here, together with actual cost data for one typical installation. The pros and cons of the gas engine should be weighed judiciously before selecting this type of system, as there are many factors to be considered.

BY ROBERT S. CURL
Principal

and

ROBERT C. MARSH
Chief Engineer
Air Conditioning Div.

Robert S. Curl and Associates
Consulting Engineers

A NATURAL GAS ENGINE is very similar to the device that powers an automobile. Take this car engine, trade the carburetor for an air mixer, put an automatic foot on the accelerator, and for all intents and purposes you have a natural gas engine.

Natural gas engines are not new, but it is only recently that the development of higher speed machines have made the use of this type of drive practical for operating air conditioning equipment. Most industrial gas engines have maximum speeds of 1200 rpm in the larger sizes. Higher speeds than this are required because of present day refrigeration equipment which runs at speeds up to 2400 rpm sucessfully in reciprocating machines and up to 14,000 rpm in centrifugal machines.

What Are Features and Shortcomings?

Some of the important features of the gas engine drive are the elimination of electrical switchgear and transformers, and the ability to provide flexible loads (a gas engine can handle loads varying from 100 percent down to about 10 percent without cycling). Costs of 75 to 160 hp gas engines are approximately the same as for electric motors with reduced voltage starters.

Although noise is a greater problem than with small sized electric motors, a properly cared for, jacketed, and insulated gas engine, is quieter than the refrigeration equipment it drives and compares favorably with a steam turbine or an electric drive with gear increasers such as are used in larger sized centrifugal machines.

Speed and capacity control using gas engines is almost infinite and is very simple since only a control device operating the governor lever is needed. Reduced speed with consequently reduced power input reduces fuel consumption.

Since gas engines are similar to automotive engines, maintenance can be provided by good automotive mechanics.

Maintenance — such as replacement of crankcase oil, spark plugs, and general overhaul — requires more attention than an electric motor. At the same time, it does not require much more than should ordinarily be provided for any other type of refrigeration plant.

Unless properly installed, vibration may arise in piping and foundations. This may affect occupants of the building in which the machinery is located.

What Problems Affect Design, Operation?

Special problems of installation and operation of a gas engine drive are as follows:

Since some internal combustion engines have extremely low torque at low speeds, devices should be provided to permit the engine to reach idling speed before picking

Systems

up the load. This is done by the use of friction, slip, or magnetic clutches or fluid drive with blocking to create a lockup speed near or above the idling speed of the engine. A load should be minimum at minimum speeds and, in the case of air conditioning, this can be provided by means of unloaders or bypass devices on the compressor.

Both a-c and d-c electric starting systems experience difficulties. D-c systems are adversely affected by battery and generator voltage variation. A-c systems have problems with starting relay devices of the time delay type.

Consumption of lubrication oil under certain operating conditions requires addition of oil daily or an automatic oil feeding device in the crankcase.

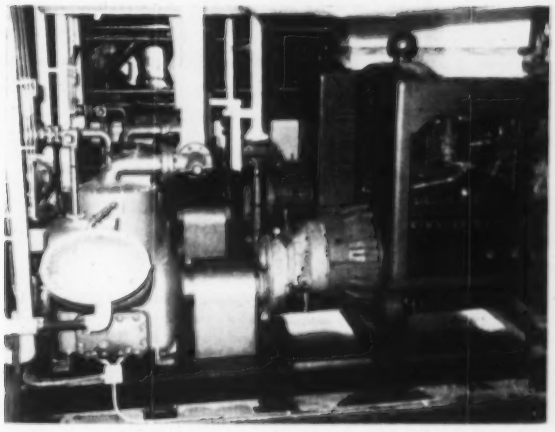
Ventilation of the engine to remove radiated heat from the surrounding area and enclosure of the engine should receive design attention. Likewise, noise control should be given careful consideration.

Installation of exhaust piping and application of mufflers, vibration isolators, and insulation requires specialized experience and design knowledge.

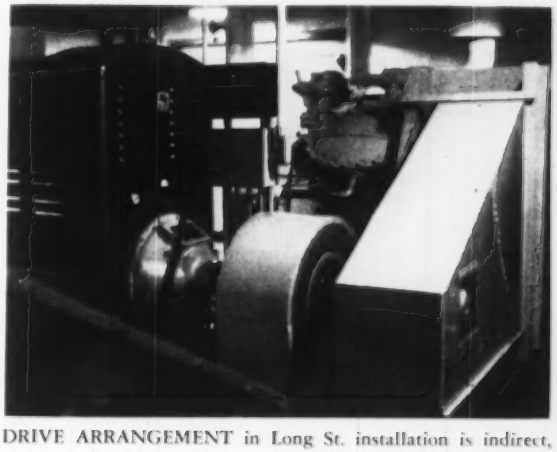
Either v-belt, gear box, or direct drive can be used, depending on the speed of the load, its location, and its application. Due to the possibility of harmonic vibrations, reciprocating engines should not drive reciprocating compressors of similar cylinder arrangement except through vibration absorbing devices like fluid couplings or belts. Direct gear drives, under certain conditions, cause considerable heat or objectionable harmonic vibrations. (Operation of rotary or radial type refrigeration compressors with reciprocating engines have produced no vibration of this type.)

The exhaust system which carries the hot combustion gases out of the building consists of exhaust piping, mufflers (either normal or water cooled), and, in most cases, flexible connections in the exhaust pipe between the engine and the exhaust piping to the outside. If exhaust pipe temperatures reach 1000 to 1200 F, the exhaust system should be properly insulated or shielded for fire protection and to prevent abnormal heat radiation. Excessive heat can be removed by placing the muffler and exhaust pipe in the ventilation duct from the engine.

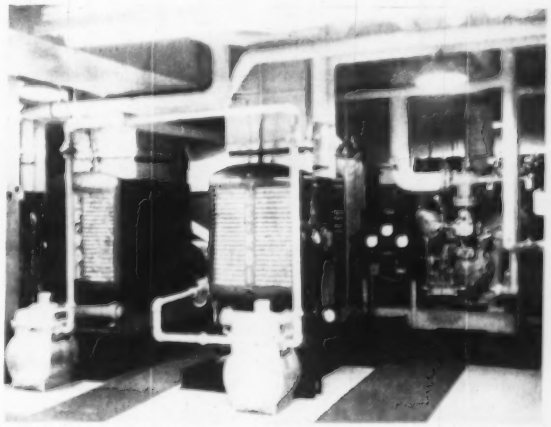
Engine compressor arrangement foundations can be totally floated on vibration isolators. However, provision



HEART OF SYSTEM serving Front St. building of Ohio Fuel Gas Co. comprises engine compressors direct connected to drives, all mounted on unitary bases



DRIVE ARRANGEMENT in Long St. installation is indirect, using clutch, fluid coupling, v-belt drive housing, idler sheave. Several other drive types are available



PRECAUTIONS TAKEN to minimize time loss due to breakdown provided for installation of dual equipment, including these two gas engines. Note ventilating ducts atop engines to carry off exhaust and cool engine, gas meters in foreground

should be made for belt take-up if belt driven, and for arrangement of engine coupling or gear box and compressor proper levels for alignment in direct driving operations. Steel bases on vibration isolators with minimum of mass foundation have been successful. Proper selection of these isolators for weight, frequency, and location is a requisite for successful application.

Engine Has Six Essential Components

There are six essential components of a natural gas engine:

1) *Engine block*: The engine block can be identical to that used in the gasoline engine. The majority of those in use for air conditioning applications are designed for top speeds of 1800 to 2400 rpm and higher, and are more compact and lighter in weight than the heavy duty, slower speed type. Truck engines, which are more rugged than the automotive type, are being used but do not appear to have a definite advantage over the properly applied high speed automotive type of machines since the conditions of operation are usually controlled and load changes are always gradual. Most power unit applications are subjected to widely varying ambient conditions and sudden load changes.

2) *Starting system*: Several types of starting systems are available:

a) D-c starters with batteries (normally 12 or 24 volts) similar to automobile starting systems, equipped automatic starting devices having intermittent cranking cycle, and safety shutoff

b) A-c systems using a-c motors and cycling starting control

c) Hydraulic systems with small hydraulic pumps, accumulators, and hydraulic starter motors

d) Compressed air or pneumatic systems using small pneumatic compressors, accumulators, and air turbine starting motors.

3) *Ignition system*: Distributor systems similar to those used on the automobile require d-c ignition systems and may be subject to frequent maintenance of breaker points and condensers. Magneto systems are more satisfactory for most installations since they generate their own current for ignition and are independent of the starting electric systems. They are also generally free of maintenance problems.

4) *Controls*: Safety control is provided for oil pressure, water jacket temperature, and overspeed. In addition, automatic gas valves are necessary to stop engines with magneto systems and to prevent combustion in the exhaust pipes of engines with distributor ignitions.

5) *Instruments*: Instruments normally used are tachometers, ammeters (if d-c), oil pressure gages, and recording hourmeters to serve as guides to oil change requirements and hours of operation.

6) *Jacket cooling system*: A water cooled jacket is practically mandatory in larger sizes and normally is used with a small heat exchanger since the jacket water pressure cannot exceed 10 lb. Excess pressure on jackets will cause leakage into cylinders through head gaskets or leakage at flexible hose connections.

As was stated earlier, gas engines are not new. An installation of the type driving a refrigeration compressor was in operation at the Ohio Fuel Gas Co., Columbus, for 16 years. Although slow in speed and of difficult application, this engine was examined when it was dismantled last year and the cylinder walls, pistons, and rings were found to be in good condition. The machine had been overhauled several times, the greatest difficulty being in the excessive pressure in the water jacket created from a direct circuit with the cooling tower located three stories above.

Since natural gas burns clean in an engine, very little sludge is generated in the crankcase. The higher temperature and continuous operation has a tendency to consume more crankcase oil than normally in an automotive type engine. However, gas engines require fewer oil changes since there is no crankcase dilution.

Records show that these engines have very long operating spans between overhauls. With reasonable care this period can be at least 10,000 hr. Where adequate maintenance is not available, automatic oil level devices should be provided for the crankcase.

Since approximately 3 percent of the fuel input to the engine is lost to radiation, it is recommended that jackets enclose the engine to reduce the heat transfer to the equipment room. This will also reduce the noise level.

Cite Typical Applications

The installations serving the headquarters office buildings of the Ohio Fuel Gas Co. are typical applications of gas engine driven air conditioning systems. The company's Long St. and Front St. buildings were both air conditioned as a result of a modernization program.

The Long St. building was formerly a factory and required complete interior revamping. This building, in addition to its use as an office facility, houses the gas fired boiler room supplying heat for both buildings, the company cafeteria, and executive dining room. The internal load is exceptionally high due to the number of business machines located in some office areas.

Both buildings are set up on a continuous, double-duct, hot and cold deck system to provide maximum flexibility for future office changes. This system allows the greatest variation of load characteristics and type of office arrangement at a minimum cost for future rearrangement.

The Long St. structure has a much larger ventilating load than the Front St., due to the cafeteria and a greater number of occupants. The transmission load on this building is extremely small — only 10 percent of the total cooling load. This is primarily due to the small amount of window area and the fact that the building is almost square and six stories high.

The Front St. building has a much larger transmission load due to its arrangement of sections with one, two, and four floors above grade. This results in a much larger wall exposure.

The Long St. building arrangement physically worked out best with one large air handling system because of space required for equipment and risers. Due to variations in height, exposure, and structural problems at Front St., it was found most feasible to design three air handling units and a chilled water system.

The units in both buildings are of the built-up type and, in the Front St. building, are located on the roof in penthouses. The aforementioned 16-year-old system had been located in this facility. The cooling tower used for this unit and other cooling was still serviceable and a 200 ton tower was added in parallel with it to provide capacity for the entire building.

Precautions were taken in the design to avoid or minimize any lost time due to a breakdown of the air conditioning system. In nearly all cases, the equipment is dual. For instance, the Front St. building has two cooling tower pumps, two chilled water pumps and two gas engine compressors. Each single unit is capable of handling approximately two-thirds of the load, thus enabling the building to remain occupied even in the worst weather in the event of a breakdown.

The following tabulation gives more of the detail characteristics of the systems in each of the buildings:

Item	Long St.	Front St.
Type of system	Direct expansion	Chilled water
Air handling systems	1	3
Refrigeration capacity	200 ton	300 tons
Gas engine capacity	2 units at 137 bhp	2 units at 215 bhp
Type of drive	V-belt	Direct (2 to 1 gear reduction)
Design load	74 tons (vent) 184 tons (total)	44 tons (vent) 239 tons (total)
Ventilating load	40 percent	19 percent
Internal load	50 percent	24 percent
Transmission load	10 percent	57 percent
Total air circulated	60,000 cfm	92,000 cfm
Number of zones	60	16
Refrigerant or chilled water control system	Pneumatic and 12volt d-c	Pneumatic and 24volt a-c
Number of floors	6	2, 5, and 5
Total Floor area	66,000 sq ft	84,000 sq ft
Installed cost per ton (complete system)	$870.00	$945.00
Initial startup	1956 season	1957 season

How Much Does It Cost?

The Front St. system has been in operation only for one season and it is felt that single season operation records are not sufficiently typical to be indicative. Consequently, only the figures on two years of operation of the Long St. building system are given as follows:

	1956		1957	
	Engine No. 1	Engine No. 2	Engine No. 1	Engine No. 2
Hours of operation	3144	3090	2152	1995
Gas consumption	2,599,000 cu ft	2,861,000 cu ft	1,761,000 cu ft	1,750,000 cu ft
Oil consumption	79 gal	78.5 gal	39.5 gal	37 gal
Gas cost	$1702.00	$1758.00	$1154.00	$1,135.00
Oil cost	$ 57.00	$ 56.50	$ 28.50	$ 26.50
Total operating cost per hr	$ 0.558	$ 0.588	$ 0.554	$ 0.581

Note: Approximately 1000 hr more of operating time was accumulated in the 1956 (initial) season than in the 1957 season. This was primarily due to extra operation for test and adjustment since this was a new combination of components and control methods.

Comparison of energy costs was considered in initial selection of the system. It was decided that the load factor (average percent of design load) be taken at 80 percent for the period from April 15 to November 15 when mechanical refrigeration is needed. Since hours are recorded, this establishes a basis for comparison of systems at 313,000 ton hours for the 1957 season.

An operating cost comparison shows that the actual engine oil and gas consumption cost $2342.00, while the equivalent 259,500 kwhr for an electric system, at $0.015 per kwhr, would have cost $3890.00.

The original selection of this system was based on past experience with this type of equipment and on engineering economy studies. It has been very rewarding to have these predictions substantially borne out. Of more than passing interest is the fact that an engine maintenance allowance for both engines was set up at $227.00 for the 1957 season and the actual cost was well below this. ∓

Light Wall Stainless Steel Piping Saves Time, Money

. . . in chemical process installation

LEAKPROOF, NONCORROSIVE piping is essential for the manufacture of polyethylene, partly because of the volatile nature of the process, but mainly to prevent product contamination. For economy as well as safety, light wall stainless piping is installed in the Koppers Co., Inc., polyethylene plant in Kobuta, Pa., according to the Horace T. Potts Co.

Schedules 5 and 10 stainless steel pipe are joined directly by welding, or by flanges that allow for future changes. Light wall pipe not only substantially reduced the material cost, but also cut by 70 percent the time for installation.

The bulk of the saving in installation time was the result of the elimination of back welding, previously necessary to correct leaks at the joints.

Joints are made with stainless steel fittings. Permanent connections are welded. To simplify the operation, an aligning connector fits over the ends of the sections to be connected. Either the light wall pipe or the fitting itself can be expanded directly into the flange for connections that may later be changed. The flange itself is bolted to another flange so that the joint may later be disconnected to provide for the addition of new equipment or other changes.

The company plans installation of light wall pipe in four more plants in its chemical division. One of these is the waterline feed to a reactor process. Another is in the firm's polystyrene plant that is undergoing expansion. ∓

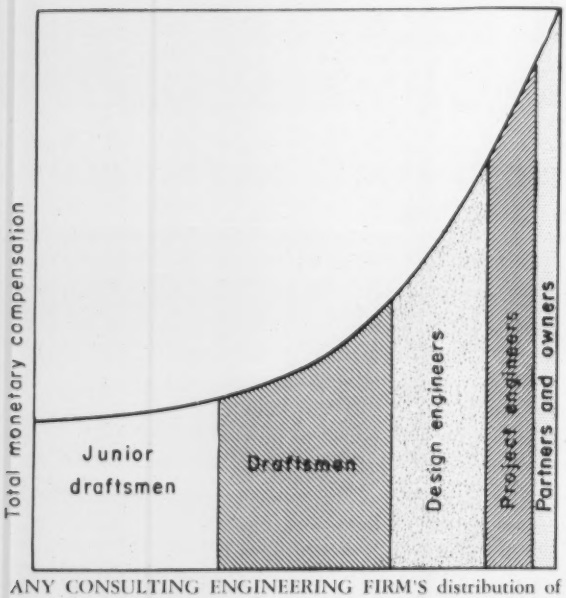
Engineers Probe Management Problems

. . . iron out matters of common interest at University of Wisconsin Seminar

BY HARRY J. SCHARRES
Design Engineer and Partner
E. R. Gritschke & Associates, Inc.
Consulting Engineers

THE PROBLEMS of business management and engineering practice for the professional engineer were dealt with comprehensively in a conference at the University of Wisconsin in Madison recently. A large attendance pointed out the need felt by engineers for more opportunities for the free exchange of ideas on the practice of engineering. Participants represented 25 cities and towns in nine midwestern states.

In his welcoming address, Dean Kurt F. Wendt, College of Engineering, emphasized that the real importance of the conference was not so much the subjects that were to be discussed in formal sessions, but rather the gathering together of engineers from many parts of the country for informal discussions and the sharing of information. The keynote of the conference was well phrased by Dean Wendt when he said, "Proficiency is necessary, but it is also necessary to make a living."



ANY CONSULTING ENGINEERING FIRM'S distribution of earnings can be shown as above to give diagrammatic representation of organizational structure. Monetary compensation was major discussion topic at conference

The problems of staffing and organizational structure were discussed by Arthur L. Spaet, Slocum and Fuller, New York, who outlined the typical well organized engineering firm staff structure as follows:

1) *Nontechnical personnel*: clerk (file clerk and general production housekeeper), secretary, bookkeeper, and accountant.
2) *Technical personnel*: junior draftsman, draftsman, designer, senior designer, and project engineer.

Duties and responsibilities of each firm member must be well defined. The prime rule in organization discipline is that each member be responsible to one person only. Mr. Spaet's own experience has proven that, when a good organizational structure is established, efficiency is increased enormously and employee morale is maintained at the highest level.

Group discussion on the subject of salary and benefits brought out the point that many bonus plans are popular at the time the checks are issued, but are very ineffective as incentive producers during the time in between. Any plan adopted, whether it be bonus or profit sharing, must be devised by both employee and employer representatives and the adopted plan must be sold to the remainder of the staff. In any event, the plan must be flexible to suit changing conditions and profitable enough to maintain enthusiasm among the employees.

Mr. Spaet also presented a list of qualities to look for in interviewing job applicants. Among these are honesty and good general character, good or presentable appearance, sincerity, a record of good job stability, willingness, alertness, natural curiosity, possible potential to the firm, and ability to demonstrate proficiency (solving hypothetical problems). He stated that it is important to ask for and check all applicants' references.

A very lively discussion followed Col. Herbert Milwit's talk on "contractural relations with the government." One member of the group mentioned that many years ago it was said of government contracts that, "If the contract was faulty it was imperative that the fault be incorporated

into the finished project." Col. Milwit gave assurance that this is certainly not the situation today and that government relations with engineers are constantly improving to everyone's satisfaction.

In the discussion of "business management," Jack D. Train, Skidmore, Owings, and Merrill, Chicago, stated that, "If we are to sell ourselves as professionals we must organize each department *as* professionals—with accounting and business departments included."

A very detailed analysis of budgeted costs was presented for the purpose of determining a more realistic and equitable engineering fee based upon the individual project—the basic formula being: *fee = cost + profit*.

It was generally agreed that the percentage basis which is in general use for determining engineering fees is most unsatisfactory, since the ultimate result will be "the better the engineering the less the fee."

All participants in the conference were owners, partners, and top supervisory personnel of consulting engineering firms. Due to the success of the meeting, it was voted unanimously that similar conferences be held annually.

THE LAW AND YOUR PROFITS

Sound Contract Stands Up in Court

BY WILLIAM HURD HILLYER

PRIOR or contemporaneous promises not embodied in a written contract are deemed abandoned, one state supreme court decided recently. The sole exception is when it appears that the parties did not intend that the writing should express the whole contract. In any event, due to frequent lack of full and specific writings, the atmosphere of the transaction tends to be highly technical. We shall see how a well written contract protected a contractor.

Antarktik Cold Storage Co. was housed in a five-story warehouse building with the main engine room on the ground floor. In mid-November, Antarktik entered into a written agreement with Chilpipe to install new brine piping in a room adjacent to the engine room. There were brine coolers and connected piping on the fifth and other floors.

A few days before the contract was signed, an engineer representing Chilpipe had approached Antarktik with written proposals for modifying the cold storage company's refrigerating system. These proposals were not accepted by Antarktik.

The contract, which was signed, expressed the terms relating to machinery, materials, and labor to be furnished by Chilpipe and also indicated that much of the work in connection with installing the brine piping was to be done by Antarktik's employees. The document expressly stated that it contained all agreements between the parties and that there was no agreement, written or otherwise, which was not set down therein. It further stipulated that no person could change any of its provisions nor waive any of Chilpipe's rights without written authority from one of his duly authorized representatives.

The piping was completely installed by the following June. On July 30 an ammonia leak occurred on the fifth floor of the warehouse. Antarktik requested that Chilpipe repair the leak.

When the repairmen arrived, they found the ammonia fumes so strong that they could not work without wearing gas masks. Thus protected, the workmen discovered that an oil drain pipe leading from the evaporator had burst and that live ammonia escaping from the pipe caused the fumes in the storage compartment. They shut off the leaking pipe and corrected the trouble.

Before leaving the premises, Chilpipe's workmen instructed Antarktik's engineer to let them know, day or night, if anything further was required. (Chilpipe had previously been taking care of the system's repairs.)

Only a few hours later, ammonia was again escaping on the fifth floor. An Antarktik employee found an open uncapped ammonia pipe, which had been cut by Chilpipe's workmen. He closed the pipe temporarily, and later he welded it shut.

A large quantity of perishable foods which were stored on the fifth floor were, according to evidence, damaged by the ammonia fumes.

Antarktik alleged that Chilpipe had agreed to do whatever was necessary "with respect to the piping of ammonia in connection with the installing of the refrigerating system."

WILLIAM HURD HILLYER, *author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. He has an extensive practical legal and financial background.*

This series presents actual cases. All names are, however, fictitious. It should, of course, be remembered that laws vary in different states.

Specifically, it was asserted that defendant Chilpipe and his co-defendant employee had "failed to make proper provision for preventing the circulation of ammonia to the brine cooler on the fifth floor." The July 30th leak, it was claimed, resulted from such failure. Furthermore, the warehouseman contended that Chilpipe and his employees "had cut the ammonia-line and left the cut end open so as to permit ammonia to escape and damage the foodstuffs."

In the trial court, defendants Chilpipe et al denied that there had been any agreement between parties "to do whatever work was necessary" in connection with installing the refrigeration piping system. They denied that they had failed to perform any of the work required under the terms of the contract. Pursuant thereto, they alleged, they were not obligated nor permitted to make provision for preventing the circulation of ammonia to the fifth floor brine cooler.

After an adverse decision in the trial court, Antarktik appealed. In the supreme court he averred that before he had entered into the written agreement with Chilpipe he had intended to install new refrigeration piping because of the difficulties he had experienced with the old, and that prior to the signing of the contract "the old evaporator on the fifth floor housed the ammonia which was then fed through a series of pipes to the remaining four floors of the building."

As a safety precaution, Antarktik contended, Chilpipe's sales engineer had suggested that the ammonia be housed on the first floor and that the old evaporators or brine containers on the fifth floor be discontinued, "since they would serve no other function in the refrigeration piping system; that such was the intention of parties when the suggested change-over was proposed . . . and that such was the purpose of the contract."

The higher tribunal took cognizance of nine separate refusals by the trial court to permit the engineer to answer as many questions. Conversely, five refusals were directed at plaintiff Antarktik's counsel while examining that concern's president on the stand.

The trial court held that "parol" (oral) evidence on the subject matter was not permissible because the written contract between the parties was not ambiguous and that it was "an integration of the entire transaction."

Following a lengthy review of mechanical details, concepts, and counter-concepts, the higher tribunal sustained the lower court's position that "the contract plainly and clearly" indicated the work to be done by Chilpipe. Furthermore, the justices declared that "the claimed negligence referred to acts on the part of Chilpipe which are outside the terms of the written contract."

In addition, the higher court held, "no recovery for damages could be had by Antarktik in view of the jury's finding that all the damage to foodstuffs occurred before the defendant's workmen had left the premises. The trial court's judgment — adverse to Antarktik — was affirmed. ∓

Big Spokane Heat Pump Reports Efficient, Economical Operation

. . . according to AIEE paper

THE THIRD LARGEST heat pump system in the U.S. is heating and cooling Washington Water Power Co.'s new set of buildings at Spokane efficiently and economically, it was reported by J. A. Wright, a company engineer, in a paper, *Centrifugal Heat Pump System for Service Center*, presented during the Pacific general meeting of the American Institute of Electrical Engineers.

Principal components of the heat pump system are two centrifugal compressors. The first, a 285 ton unit, was installed in 1956. The second, a 530 ton unit, was put in this year. Water from an underground river is the heating and cooling source for the system, he said, adding that the water temperature varies only 3 F deg throughout the year, ranging from 49 to 52 F. A standby oil fired boiler also is included.

"The coefficient of performance appears to be over 4," Mr. Wright said. "Spot checks on the 285 ton heat pump have indicated the coefficient to be 4.5. This means that for every kilowatt hour used in operating (including well pump and auxiliary equipment) heat is available to the buildings in the equivalent of 4 to 4.5 kwhr.

"With a rated motor efficiency of 92 percent, the cost for running the two heat pumps at full load for one hour under the rate filed for this type of load is $3.661. Based on a total specified output of 9 million Btu per hr at full load, this results in a cost of $0.407 per million Btu at the heating supply header. This compares with a cost of $1.20 per million.

"The small heat pump has operated through two heating seasons and one cooling season during which it supplied adequate heating and cooling for the service building and garage. The lowest official temperature in Spokane during that time was −18 F. The highest was 96 F.

"Since the other two buildings have been completed only this summer, there is no operating experience for the total combined load. But from observed performance of the smaller heat pump, which was better than design, it is anticipated that there will be considerable margin over design performance for the entire heat pump system." Mr. Wright concluded. ∓

How to Figure Duct Fitting Losses

BY JAMES A. HODDE
Mechanical Engineer
California State Div. of Architecture

THE CHART on the next page provides a convenient shortcut to figuring pressure losses through duct fittings. It converts duct fitting configurations and air velocity directly to static pressure loss in inches of water gage and is based on the concept of velocity head in a fluid which was first observed by Torricelli in 1643. He described it with the equation:

$$V = \sqrt{2gh} \quad \text{.....[1]}$$

where:

V = fluid velocity, fps
g = acceleration due to gravity, 32.2 fps^2
h = velocity head, ft.

Since air is a fluid it obeys this relationship while flowing in a duct. In the following discussion Equation 1 will be put in a more usable form.

The pressure-density-height relationship in hydrostatics is:

$$P = \rho h \quad \text{.....[2]}$$

where:

P = pressure in fluid, psf
ρ = density of fluid, lb per cu ft.

If Equations 1 and 2 are combined, they yield:

$$V = \sqrt{2gP/\rho} \quad \text{.....[3]}$$

The term P is often expressed in inches of water gage rather than in pounds per square feet, *where*:

1 in. WG = 5.196 psf.

With this value, Equation 3 becomes:

$$V = \sqrt{2g(5.196)P/\rho} \quad \text{.....[4]}$$

For standard air, as defined in the ASHAE Guide, the density is 0.07488 lb per cu ft. Using this figure, Equation 4 reduces to:

$$V = 4005\sqrt{P} \quad \text{.....[5]}$$

Equation 5 restates the law of Torricelli in a more convenient form. The velocity of air at standard conditions in a duct is equal to 4005 times the square root of the velocity head measured in inches of water gage.

The pressure losses due to a change of direction, acceleration, or deceleration of a fluid flowing in a pipe were found in early experiments to be proportional to the square of the velocity. Thus:

$$p = k\,(V^2/2g) \quad \text{.....[6]}$$

where:

p = pressure loss, ft
k = a dimensionless constant, designated as "loss coefficient" for a given flow geometry.

Equation 6 is equally valid for the flow of air in a duct. However, for the magnitudes of pressures encountered, the units are disproportionately large. Therefore an extension of Equation 6 using the system of units in Equation 5 gives the following result:

$$p = n\,(V/4005)^2 \quad \text{.....[7]}$$

where:

n = a dimensionless constant, designated as the "number of velocity heads lost" through a given flow geometry.

For most of the duct elements used in air conditioning and ventilation practice, n varies from 0.01 to around 10. It should be carefully noted that n is practically constant for relatively high velocities, having a tendency to increase as the velocity decreases.

The value of using this method to figure losses through duct elements is that pressure losses can be found for any flow geometry simply by knowing the one constant, n. Equation 7 is plotted in nomographic form on the following page for several types of duct elements.

The flow must be turbulent for the chart to be valid. This condition is met when the Reynolds number is greater than approximately 4000. For rectangular ducts the Reynolds number is given by:

$$Nr = 2Q/\nu(a + b) \quad \text{.....[8]}$$

and for round ducts:

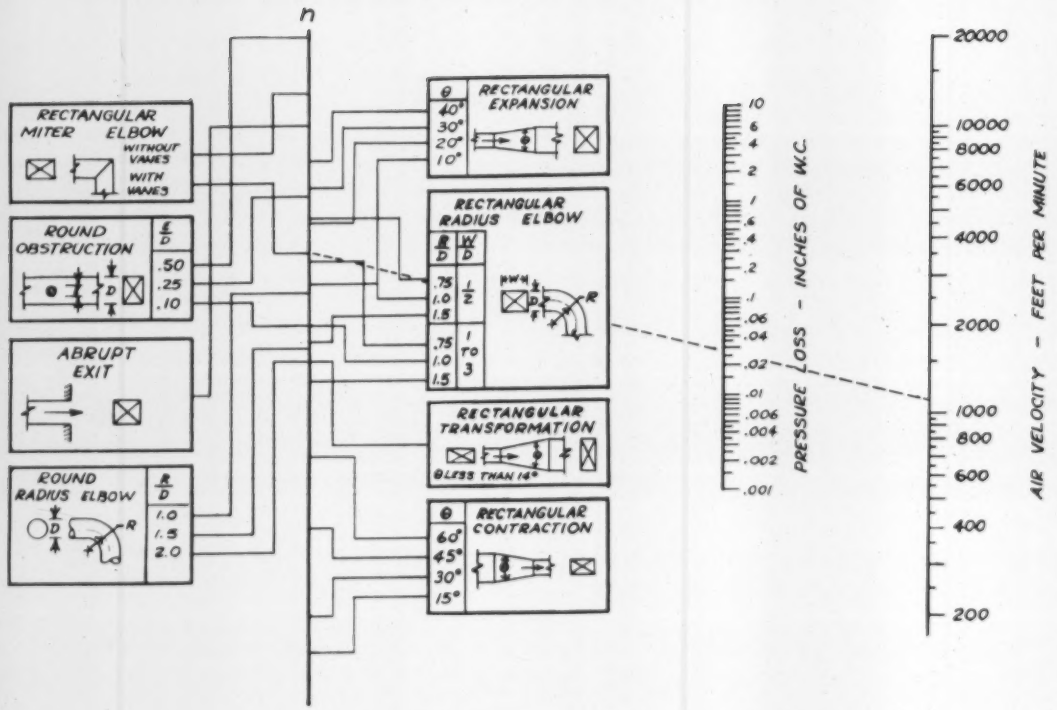
$$Nr = 2Q/\nu(\pi R) \quad \text{.....[9]}$$

where:

Nr = Reynolds number
Q = air flow rate, cfm
a and b = dimensions of rectangular duct, ft
R = radius of round duct, ft
ν = kinematic viscosity of air, sq ft per sec.

Tear out along this line

HPAC DATA SHEET



TO FIND pressure drop for a rectangular miter elbow with vanes, if air velocity is 1100 fpm, proceed as follows: (1) find point on line *n* intersected by rectangular miter elbow with vanes; (2) connect this point and 1100 fpm on air velocity scale by straight line; (3) read pressure drop of 0.026 in. WG at point where line crosses pressure loss scale

Tabulated below are the minimum velocities which satisfy the condition for turbulent flow for various sized ducts of both round and rectangular cross-section.

Observe that for small ducts the minimum velocity exceeds 100 fpm but is less than 200 fpm. Therefore the minimum velocity on the accompanying chart is 200 fpm.

Round duct		Rectangular duct	
Diameter, in.	Minimum velocity, fpm	Size, in.	Minimum velocity, fpm
3	163.0	2 × 4	184.0
5	98.0	3 × 7	117.0
10	48.9	8 × 10	55.0
20	24.5	14 × 25	27.5
30	16.3	25 × 30	18.2
40	12.3	30 × 45	13.6
50	9.8	45 × 60	11.1
60	8.2	50 × 60	9.0

Note that this method gives only the shock losses due to a change of direction or acceleration of air in a duct system. To this must be added the pressure loss due to the skin friction in a straight duct. The following limitations should be observed when using this chart: (1) for rectangular expansion, the pressure loss refers to the difference in velocity pressures across the fitting and is valid for an inlet to outlet ratio of from 2 to 4; (2) for rectangular transformation, the pressure loss is valid for ratios of width to depth of more than ½; (3) for rectangular contraction, the pressure loss is a function of the velocity in the smaller duct. ≠

HEATING, PIPING & AIR CONDITIONING

JOURNAL SECTION

OF

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

CONTENTS

President's Message
Special Meeting on Merger Plan 154

Air-Cooled Condensers
By Otto J. Nussbaum 155

Block and Pipe Insulations
By Ray B. Crepps 161

Probe for Thermal Conductivity Measurement of Dry and Moist Materials
By W. Woodside 163

Frost Formation and Heat Transfer on a Cylinder Surface in Humid Air Cross Flow: Part I — Experimental Study
By P. M. Chung and A. B. Algren 171

Candidates for Membership 180

Obituaries 181

Philadelphia Host In January For Annual Meeting, Exposition 182

Presidents and Secretaries of Society Chapters and Branches 183

President's Message

Special Meeting on Merger Plan

Here are the latest developments in connection with the proposed merger of our Society and *ASRE*.

In each issue of the JOURNAL in recent months, I have devoted my message to keeping you supplied with information on this merger project.

There are two outstanding reasons for doing this. One is the conviction that this merger proposal is the most important single item of business now under consideration by the membership. The second reason is that it is my desire that the membership be kept continually and accurately informed as to what is going on as details of the plan are worked out. Without knowledge the members cannot vote thoughtfully and with due consideration when the time for voting comes.

My progress report on this page in the August issue of the JOURNAL mentioned meetings held in Chicago on July 18 and 19. Following the Chicago meetings and in pursuance of the general plan, a 4-page printed brochure was prepared and was mailed about the middle of August to the membership with the approval of the Executive Committee of the Council. This brochure is a *Summary of the Proposed Merger Plan*. It contains the essential features of the plan as approved at the Chicago meetings, and an explanatory letter which I prepared.

It is my hope that this brochure contains sufficient information to permit every member to gain a clear understanding of the plan.

Also following the meetings in Chicago, I sent a report to the members of our Council on July 21, 1958 acquainting them with what had taken place. In that letter, I also asked the Council to call a Special Meeting of the Society in accordance with the procedure contained in Article VIII, *Section 1* of the By-Laws. This has been approved and the Special Meeting will be held in Chicago on December 1, 1958 at 10 a.m. in the Conrad Hilton Hotel. The purpose of this meeting is to consider and vote on the approval or disapproval of the *Proposed Merger Plan*. The voting will be either in person or by proxy. It is expected that a letter containing the official notice of this Special Meeting will be sent to you during the third week in October. This letter will also contain a proxy for use in case you cannot be present in person at the Special Meeting.

I especially urge that you study the brochure sent to you in August in order that you may be fully informed before casting your vote. Also the other Officers and the Council strongly urge that you exercise your voting right. The Society is a Membership Corporation and this important subject of a merger can be resolved only by a vote of the membership.

E. R. Queer

PERSONNEL

E. R. QUEER
President

A. J. HESS
First Vice President

WALTER A. GRANT
Second Vice President

JOHN H. FOX
Treasurer

A. V. HUTCHINSON
Executive Secretary &
Manager of Publications

J. W. MAY
Chairman
Publication Committee

H. M. HENDRICKSON

W. L. ROSS

C. H. B. HOTCHKISS
Editor

ANNE O'NEIL
Assistant Editor

Information on other Society personnel can be found on page 183

Air-Cooled Condensers

By

Otto J. Nussbaum

The author is chief engineer of the Kramer Trenton Company, Trenton, N. J. A presentation at the Symposium on Condensing Methods at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Minneapolis, Minn., June 25, 1958.

USE of air as a condenser coolant was considered impractical until the middle of the twentieth century. This attitude was due to the fact that the traditional ammonia compression cycle was based on *standard conditions* of 5 F evaporating temperature and 86 F condensing temperature. Because 86 F ambient temperature is often exceeded in most of the civilized world, the use of air as a condenser coolant had to be ruled out until refrigerants were introduced which permitted economical operation at higher than 86 F condensing temperature.

When the main use of refrigeration changed from industrial to commercial and household applications, emphasis had to be placed on the need for a plug-in package which was ready to operate immediately upon delivery. This is difficult to accomplish with any type of wet condenser; so that the air-cooled condenser became indispensable first in domestic refrigerators and freezers and later in room air conditioners. Fig. 1 illustrates an early air-cooled condenser in a domestic refrigerator of the 1920's.

Appearance of the halogenated hydrocarbon refrigerants, permitted further advances in air-cooled condensing for commercial refrigeration. Completely assembled highsides or condensing units replaced separate compressors and

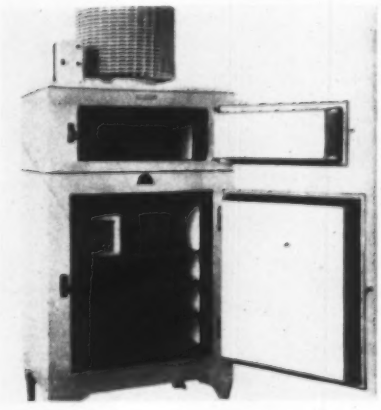


Fig. 1 — Early domestic refrigerator with air-cooled condenser (about 1930)

condensers to simplify the installation of commercial refrigeration plants. Such condensing units employed a common motor to drive both the compressor and the condenser fan; only 70 to 80 percent of the motor horsepower was available for the compressor. Furthermore, dimensional and economic considerations dictated design condensing temperatures of 120 F and higher. For these reasons, air-cooled condensing units were often rejected in favor of water-cooled condensing units which utilized the full motor

Fig. 2 — The first remote air-cooled unit condenser — used as a replacement condenser for a water-cooled condensing unit (about 1937)

power to drive the compressor, thus producing a higher Btu output per compressor horsepower.

With the growing use of wet condensing, city water mains became inadequate, water pressures dropped in many localities so that inadequate water supply caused many water-cooled condensing units to fail because of excessive condensing pressures. This problem, which required additional condensing capacity, was solved by air-cooled booster or replacement condensers, either integrally mounted or remote. Fig. 2 illustrates an early application where a remote air-cooled condenser replaced a water-cooled condenser.

Since superheat removal frequently constitutes a substantial portion of the condenser heat rejection, air-cooled condensers found further usefulness as desuperheating coils in conjunction with wet condensers. By relieving the wet condenser of its desuperheating function, it is possible to reduce the condensing pressure and achieve operating economies, particularly after the original wet condenser capacity has dropped due to scaling or insufficient water supply[1].

Beginning with the 1937 condenser, the author's company pioneered the development of the air-cooled unit condenser. The refrigeration industry was able to experiment and accumulate actual field experience with dry condensing with the remote unit condenser either as the sole condenser or as a booster. Because the full compressor motor power

[1]Exponent numerals refer to References.

can be utilized to produce useful refrigeration, so that air-cooled compressor capacity becomes equal to water-cooled units, and because of its obvious other advantages demonstrated by years of field experience, the air-cooled unit condenser has grown substantially from a small beginning.

Today, air-cooled unit condensers are successfully used in numerous installations ranging from 3 tons to 100 tons and larger (Fig. 3). Fortified by this background of experience, a paper[2] was published in 1952 by this author, proposing for the first time the use of air-cooled condensers for large tonnages, and introducing a novel type head pressure control to facilitate their use in any climate. This paper stimulated considerable discussion in the literature of the comparative merits of wet *vs.* dry condensers.

The commercial availability of air-cooled unit condensers facilitated experimentation also in residential air conditioning, a field whose potential heretofore was strictly

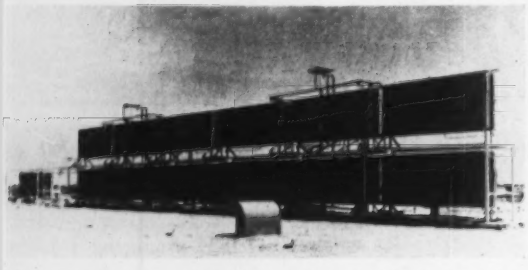


Fig. 3 — A recent 250-ton air-cooled unit condenser installation

limited to areas where wet condensing was permissible. Today, residential air conditioning overwhelmingly uses air-cooled condensing (Table 1).

General Description

Remote unit condensers (Fig. 4) consist of 3 main components: a finned condensing coil, an air handling section with a direct-driven or belt-driven fan with its motor, and a sheet metal casing. Indoor condensers for use with ducting have centrifugal fans and filters. Air is drawn through the coil; the fan and motor are usually located within the casing in the discharge air stream.

Condensing Coil: The condensing coils are usually in a vertical plane for horizontal air flow. Copper tubes and aluminum fins are used, arranged in multiple refrigerant passes. Tube sizes range from $\frac{3}{8}$- to $\frac{3}{4}$-in. diameter, tube spacing from $\frac{3}{4}$- to 2-in. centers, and fin spacing from 8 to 12 fins per inch.

The condensing coil assembly may have several individual condensing circuits with a common air handling section. The capacities and locations of the various circuits are custom made, depending on the combination of compressors used. Each circuit has its own inlet and outlet connection and uses a separate receiver and compressor.

Condenser Fan: Either propeller fans or centrifugal fans are used, depending on the application. The power requirement per air-conditioning horsepower is from 1/10 hp to 1/6 hp with propeller fans; and from 1/5 hp to 1/4 hp with centrifugal fans.

Application and Rating of Remote Air-Cooled Unit Condensers

Unlike a chassis-mounted air-cooled condenser which is preselected by the compressor manufacturer, the remote

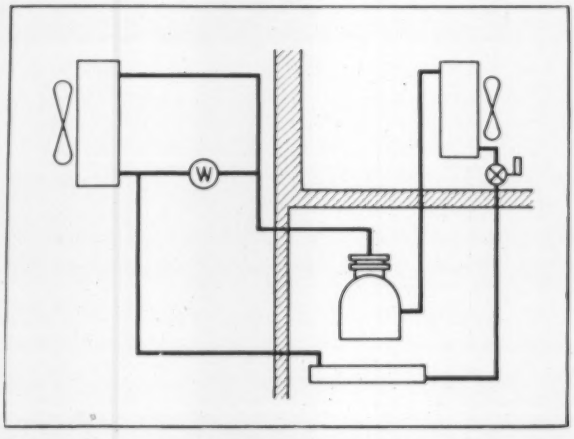


Fig. 3A — The diagram of a method of obtaining head pressure control

unit condenser is selected by the application engineer on the basis of ambient temperature at the condenser and the design condensing temperature. The condensing temperature approaches common practice with water-cooled condensers and evaporative condensers, namely 105 to 110 F,

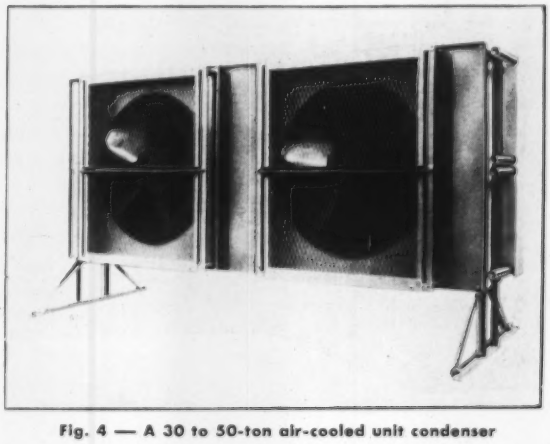


Fig. 4 — A 30 to 50-ton air-cooled unit condenser

in order to obtain the same compressor capacities as with wet condensers.

The heat rejection of an air-cooled condenser is proportional to the difference between entering dry-bulb and condensing temperature within the limits of normal application, that is from 10 to 30 F deg temperature difference.

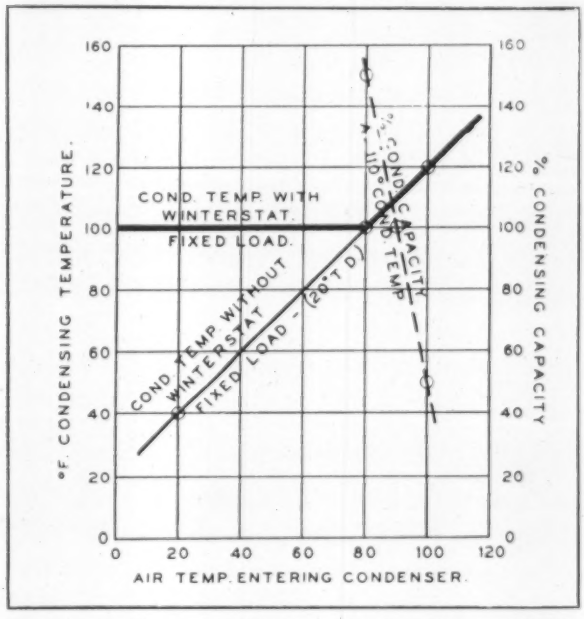

°F. CONDENSING TEMPERATURE.
% CONDENSING CAPACITY
AIR TEMP. ENTERING CONDENSER.
COND. TEMP. WITH WINTERSTAT. FIXED LOAD.
110° COND. TEMP.
CONDENSING CAPACITY
COND. TEMP. WITHOUT WINTERSTAT FIXED LOAD - (20° T.D.)

Fig. 5 — Condensing capacity vs. temperature difference (T.D.)

For instance, with 20 deg temperature difference (T.D.) the condensing temperature (Fig. 5) is 110 F at 90 F dry-bulb or 105 F at 85 F dry-bulb. At 30 deg temperature difference, for instance at a dry-bulb of 80 F and a condensing temperature of 110 F, the heat rejection of the same condenser will be 50 percent greater than for 20 deg T.D.

A remote condenser is best selected by cross-plotting condenser capacity against compressor heat rejection as shown in Fig. 6. The system performance is read at the intersection of the 2 curves. The same compressor will operate at approximately 116 F condensing temperature and 53,000 Btu per hr with a smaller condenser; or 108 F condensing temperature and 57,000 Btu per hr with the next size larger condenser. The ultimate selection depends on the actually required cooling capacity and the operating economies of each compressor-condenser system.

A code for testing and rating of remote unit condensers is in the process of preparation by *ASRE*. Pending the publication of this standard, it has been accepted practice to publish remote unit condenser ratings converted to evaporator capacity at 40 F evaporating temperature, 120 F condensing temperature, and 90 F air entering the condenser. This practice eliminates condenser heat rejection from the selection procedure and facilitates application engineering work since available compressor ratings show only net refrigeration effect and not total heat rejection.

Installation and Maintenance

Because of their relatively simple design, the installation and maintenance of remote dry condensers requires a minimum of labor. The absence of water and sewer connections and the simple electrical hookup make it possible to complete the installation without the assistance of subcontractors and without need for permits.

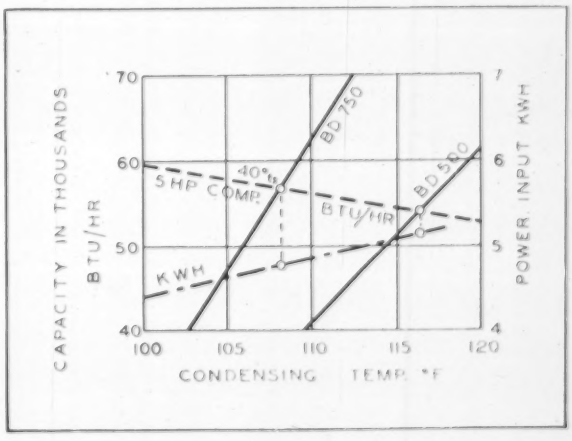
Unit condensers are located remote at any desired distance from the compressor either indoors or outdoors and can be situated either above or below the level of the compressor. Where unit condensers are located indoors, the warm discharge air must be ducted to the outside. A fresh air intake opening near the condenser is provided, which may be equipped with gravity shutters. Indoor condensers can be utilized for machine room heating during the winter and ventilation during the summer (Fig. 7).

In outdoor installations the condenser is oriented so that prevailing winds will blow towards its air intake; or discharge shields are used to deflect opposing winds (Fig. 8).

Piping practice with remote unit condensers is identical to that established by experience with evaporative condensers. Discharge piping should be sized for a total pressure drop not exceeding 3 psi. For satisfactory oil return,

Table 1 — Statistics[a] of air-cooled condenser installations in Memphis, Tennessee (1954 to 1956)

Year	Total Units	Air Cooled			Water Cooled			Percent Air Cooled	Year	Number Contractors Using Air Cooled Condensing		
		Remote	Self-Contained	Total	Water Only	With Cooling Tower[b]	Total			Total Number Contractors	Using Air-Cooled Cond.	
											No.	Percent
1954	344	84		84	260		260	24	1954	54	5	9
1955	1251	742		742	9	500	509	59	1955	16	13	80
1956	1240	952	87	1039	6	195	201	84	1956	17	17	100
1957	1064	878	132	1010	—	24	24	95	1957	25	25	100



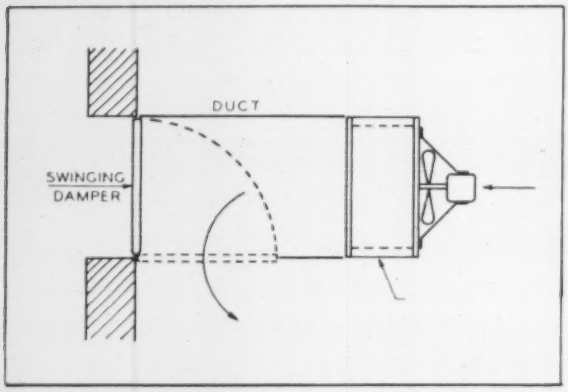


Fig. 7 — Air-cooled condenser as winter heating unit

the gas velocity in vertical upward risers should be 1000 to 1500 fpm and in horizontal discharge lines, 500 to 750 fpm. Discharge risers should be trapped in accordance with accepted practice. Horizontal discharge lines should be pitched away from the compressor towards the condenser. Discharge gas velocities over 3000 fpm must be avoided to prevent objectionable noise, vibration, and pressure drop. These rules should be observed regardless of the presence of an oil separator because some oil will always be carried past the oil separator and collect at points of insufficient gas velocity. With oil separators, a check valve should be located at the separator outlet to prevent condensation of liquid in the separator when it is in a colder location than the condenser.

Discharge piping should be well supported without transmitting vibration to the building. A muffler in the discharge line may be used (though seldom needed) to prevent noise due to refrigerant pulsation, particularly with high speed compressors.

Long discharge mains may undergo considerable thermal expansion and contraction due to temperature changes. Discharge piping must therefore be designed so that it can move without damage to itself and to the condenser. Branch lines from the discharge main to individual condensers should be looped in accordance with standard piping practice. If the receiver is located in a comparatively warm ambient, the liquid drain line from the condenser to the receiver should be oversized for gravity drainage and venting to the condenser.

Maintenance of a remote unit condenser is seldom required. Relubrication of fan motors and fan bearings should be scheduled once every 6 months to once every year, depending on location. Adjustment of belt tension may be necessary after installation and at yearly intervals.

By far the greatest percentage of unit condensers are in locations that are relatively free of dust and dirt so that cleaning will not be required. In unusually dirty locations, the condenser coil may require periodic cleaning with a long bristle brush, steam, compressed air; or in the case of grease, a cleaning solution.

Indoor condensers in dusty locations such as textile mills or supermarkets, are equipped with washable filters.

Operating Economies of Remote Air-Cooled Condensers in Comparison with Other Condensing Methods

During 3 consecutive summers, the share of air-cooled condensers installed in a typical American city[10] for residential air conditioning increased from 25 percent in 1954 to 59 percent in 1955, and finally to 95 percent in 1957. Only 9 percent of the reporting contractors used air-cooled condensers in 1954, while 80 percent of these contractors used air-cooled condensing in 1955; and in 1957, 100 percent used air-cooled condensers (Table 1). Surveys for other cities in the United States show the same trend.

Contrasting with this, one sometimes reads that *the increased acceptance of remote air-cooled condensers for large installations is somewhat surprising in view of all the apparently contrary economics of this system.* From this statement it is only a short step to the common misconception that *with air-cooled condensers the least capacity is obtained when it is most needed.* Actually, insufficiency is a very rare experience; more serious problems occur in winter when there is an over-abundance of condensing capacity.

Most published comparisons calculate condensing pressure and power consumption with various condensing sys-

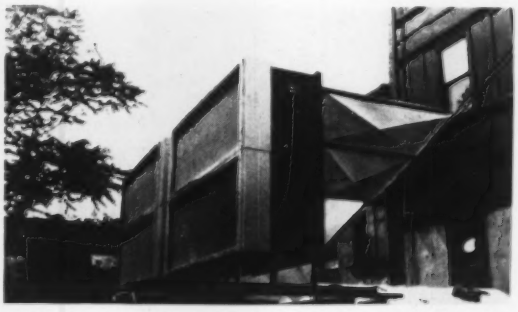


Fig. 8 — Remote condenser with wind deflecting discharge shield

tems during a single hour, usually selected at 95 to 105 F outdoor dry-bulb and 75 to 80 F outdoor wet-bulb. Such single point comparisons convincingly show the lowest system capacity and the highest operating cost per Btu for a remote air-cooled condensing system[3,4,5].

Actual observations[6,7,8] do not confirm this concept. In fact, cases are reported where changeover from cooling tower to air-cooled operation resulted in reduced head pressure and lower operating costs. Other observations of 2 equal systems operating simultaneously with a cooling

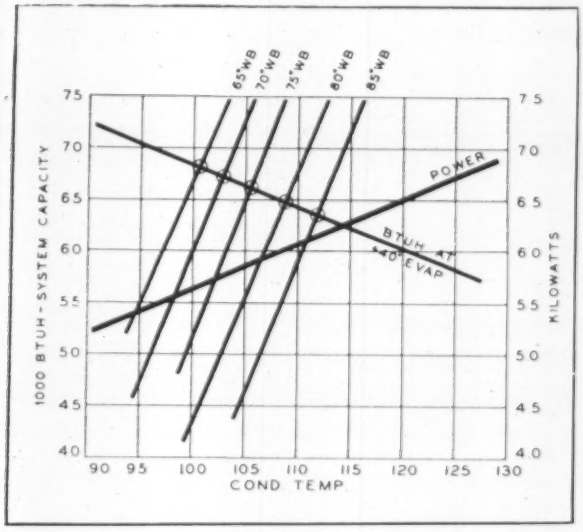


Fig. 9 — Plot of condensing pressure and power consumption with evaporative condenser at various wet-bulb temperatures. Plot is for a commercial unit using R-12 as the refrigerant

tower and a remote air-cooled condenser respectively, also indicate lower operating costs for a remote air-cooled condenser.

The answer is not surprising. *Condensers operate not only during a single* 105 *F dry-bulb hour at the height of the summer; they operate for thousands of hours during a year.* For commercial refrigeration, the dry-bulb at the condenser may vary from 0 F to 110 F during the course of a year. Of 6000 total operating hours, the dry-bulb temperature in New York City will exceed 85 F on the average during 100 operating hours. Therefore *less than* 2 *percent of the total operating time of a year-round refrigeration system will be at condensing temperatures above* 105 *F.* For a summer air-conditioning system which operates 2000 hr per year in New York City, 100 hr above 85 F outdoor dry-bulb represent 5 percent of the total operating time. Therefore 95 *percent or more of the running time of a remote air-cooled condenser, operating at* 20 *deg temperature difference between air and condensing refrigerant, will be at* 105 *F condensing temperature or lower; which equals the conventional design point for water-cooled and evaporative-cooled systems.*

Furthermore, in many air-conditioning applications the maximum load occurs during the night hours while the maximum outdoor dry-bulb takes place during the early afternoon. As a result, large air-conditioning systems with remote air-cooled condensers can be designed to operate at lower condensing temperatures than with wet condensers, and at greatly reduced cost, as will be shown here.

Aside from these general observations, a comparison of various condensing systems under conditions most unfavorable to the remote air-cooled condenser, that is on the hottest summer day, shows interesting results. For this, the official records of the U. S. Weather Bureau in Trenton, New Jersey for the 24-hr period starting at midnight of July 31, 1954 were used. Performance characteristics of a 5-hp air-conditioning compressor of well known make were plotted against condensing temperature using information from published literature. On the basis of plots such as Fig. 9, the system capacity, power consumption, water consumption and head pressure are listed in Table 2 for 24 consecutive hours for each of the following 5-hp air-conditioning systems:

(*a*) a conventional water cooled package unit with hermetic compressor;
(*b*) the same unit as in (*a*) but with a remote cooling tower;
(*c*) the same compressor unit as in (*a*) and (*b*) but with a remote evaporative condenser;
(*d*) a conventional air-cooled package unit with integral condenser (Fig. 10);
(*e*) the same compressor unit as in (*a*) but with a remote air-cooled condenser (such as Fig. 4) selected to operate at approximately 20 deg difference between air and condensing temperature.

Because outdoor temperatures of 80 F dry-bulb or 67 F wet-bulb were exceeded at all times, it was assumed that all 5 systems were running continuously during the entire 24-hr period.

The total 24-hr cooling capacities of the 5 systems are within less than 20 percent of each other. It can therefore be assumed that any one of these 5 systems might have been selected for the same calculated cooling load.

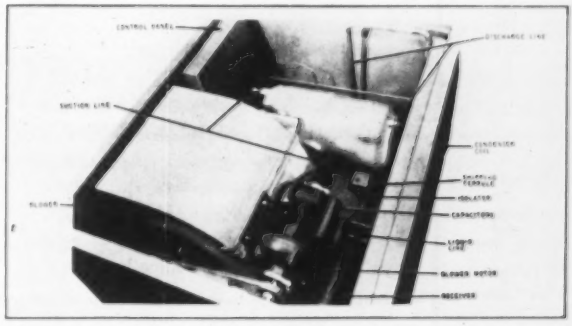


Fig. 10 — Air-cooled condensing unit package

The total electric power consumption is the lowest for the water cooled unit which operates at the lowest head pressure and requires no fan or pump. The highest power consumption occurs with the air-cooled package unit because its integral condenser operates at approximately 30 deg difference between air and condensing refrigerant. This design is dictated mainly by competitive considerations; and to a lesser degree by the amount of space physically available for a condenser coil within the confines of a practical package.

Total power consumption of the remaining 3 units (cooling, evaporative condenser, and remote air-cooled con-

Table 2 — Operating data for a 5-hp residential air-conditioning system using a unit type of condenser

(Based on Hottest Day for 1954 in Trenton, N. J.[a])

Type of Condensing Equipment	Heat, Btu		Avg Head Press. psig	Total Consumption[c]		Costs		
	Total 24 hr	Avg hr		Power kwhr[b]	Water-1000 gals.	Total, (Power plus Water)	1000 Btu per dollar	Dollars per 1000 Btu
Water Cooled (75 deg Water)	1,656,000	69,000	116	154.4	12.2	$6.37	260	0.00384
Water Cooled; With Prop. Fan Cooling Tower	1,631,900	68,000	122	160.9	0.6	$3.40	480	0.00208
Evaporative, (Prop. Fan Type)	1,576,500	65,800	129	150.2	0.6	$3.19	495	0.00202
Integral Package Air-Cooled; With Prop. Fan	1,400,150	58,500	150	184.4		$3.69	380	0.00263
Remote Air-Cooled; Prop. Fan	1,555,400	65,000	136	165.9		$3.32	468	0.00214

[a]U.S. Weather Bureau Excerpt for July 1931, 1954: Avg DB for 24 hr = 87.5 F; avg WB for 24 hr = 76 F; max. DB at 2 p.m. = 99 F; max. WB at 9 a.m. = 84.1 F; min. DB at 4 a.m. = 75 F; min. WB at midnight = 68.5 F.

[b]Total kwhr = Compressor plus condenser or tower pump plus condenser or tower fan.

[c]At 2 cents per kwhr and 30 cents per 1000 Gal.

denser) are within 10 percent of each other. From published catalog data for propeller fan towers and condensers, the total auxiliary motor requirement per air-conditioning horsepower was assumed to be 0.16 hp for cooling tower, 0.15 hp for the remote air-cooled condenser, and 0.06 hp for the evaporative condenser. Power costs were calculated on the basis of an average figure of 2¢ per kw hr.

Water consumption was based on published minimum requirements for the water-cooled condensing unit, and on 3 percent of the total water circulation for the cooling tower and evaporative condenser. Water costs were calculated as 30¢ per 1000 gallons. So far maintenance costs have not been considered, particularly those of cooling towers, the initial cost of which is usually lower than that of air-cooled equipment. A survey of 50 large cooling tower installations shows that the yearly tower maintenance cost during the first 10 years is 5 percent of the initial tower cost[11]. This figure is probably conservative because it is based on experience with large cooling towers of 14,000 gpm and higher capacities. In the industrial field, *the maintenance cost of air-cooled condensing equipment has been found to be only 25 percent that of water-cooled equipment, while the capacity loss due to fouling with increased age has been found to be less with air-cooled condensing equipment than with water-cooled equipment*[9].

Since maintenance costs of wet condensers are higher than for air-cooled condensers, they should have been added to this comparison. However, reliable figures are not available, and maintenance costs have been excluded from this comparison. Therefore, in evaluating Table 2, it must be kept in mind that *it is based only on water and power costs.* It should also be remembered that *this comparison has been deliberately made under conditions least favorable to air-cooled condensing,* that is, on the hottest reported day for an entire year.

With this in mind, Table 2 shows a total running cost for this particular 24-hr period of $3.32 for the remote air-cooled condenser, $3.69 for the air-cooled package, $3.19 for evaporative condenser systems, and $3.40 for the cooling tower system. The highest cost, $6.37, is calculated for the water-cooled system. The figure for all wet condensing systems may vary radically depending on local water costs.

Even more interesting is the expense per 1000 Btu of heat removal. It costs 0.214¢ to remove 1000 Btu with a remote air-cooled condenser, 0.202¢ with an evaporative condenser (not including maintenance cost), 0.384¢ with a water-cooled condenser, and 0.208¢ with a cooling tower system (not including maintenance costs). The highest cost of all water saving systems, 0.263¢ per 1000 Btu, occurred with a package air-cooled condensing unit. This is explained by the deliberately small condenser and low air flow necessitated by the need for low first cost and compact package dimensions. The slight apparent cost advantage in favor of the evaporative condenser will be cancelled if water treatment and maintenance costs are added.

These comparisons indicate that the *air-cooled condenser is utilized to its best advantage when it is remote* and not integrated with the package so that neither its dimensions nor its air delivery need to be restricted. This investigation also shows that the *air-cooled condenser as a separate remote unit,* sized for a condensing temperature of approximately 20 deg above ambient, *will operate at a lower cost than any other condensing system—even under the most unfavorable climatic conditions.*

References

1. Desuperheating Discharge Gas with Air Cooled Exchanger, by H. G. Venemann (*Industrial Refrigeration*, June 1954).
2. Adaptability of Air Cooled Condensers for Large Tonnage Systems, by O. J. Nussbaum (*Refrigerating Engineering*, March 1954).
3. Surveys for Memphis, Tennessee for 1954, 1955, 1956 (reprints—*Air Conditioning & Refrigeration News*).
4. You Can Do Summer Air Conditioning, by A. B. Newton (*Gas Heat*, November 1954).
5. Water Saving Devices Compared, by C. Boling (*Air Conditioning & Refrigeration News*, November 28, 1955).
6. Air Cooled *vs.* Evaporative Condensers, by C. W. Pollock (*Mechanical Contractor*, November 1957).
7. *ASRE* Air Conditioning Conference Talk, by R. A. Gonzalez (*Air Conditioning & Refrigeration News*, July 2, 1956).
8. How Power Usage Varies for Summer Air Conditioning of Identical Residences, by R. A. Gonzalez (*Refrigerating Engineering*, January 1957).
9. Operating Costs of the Air Cooled Condenser, by J. D. Loveley.
10. What Does Cooling Tower Maintenance Cost? Anonymous (*Power Engineering*, February 1957, page 79).
11. Personal communication—R. M. Armstrong.

Block and Pipe Insulations

By

Ray B. Crepps

The author is a Consulting Professional Engineer and Visiting Professor at Purdue University, West Lafayette, Indiana. A presentation at the Symposium on Thermal Insulation at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Minneapolis, Minn., June 24, 1958.

IN generations past, the caveman lived in naturally air-conditioned shelters and had most of the comforts of the modern thermal conditioned home, however without the cost of installation. Today the goal sought in most businesses dealing with the production and use of insulation products is primarily one of securing comfort and thermal efficiency in one way or another. Even though through research, insulation products can be improved thermally, their ultimate use will be determined by their adequacy in meeting the physical demands of particular installations that sometimes may have special environmental conditions.

In the past materials of many kinds have been used for insulating purposes. Some of the earlier ones, such as untreated ground corn cobs, sawdust, seaweed and others, have had merit, but not sufficient to offset encountered conditions of moisture and ventilation that have been created by modern construction practices. Many man-made inorganic insulations and organic materials treated for resistance to specific problems, such as odor, moisture and fire, have now been included on accepted lists for use in controlled building structures, appliances and industrial equipment.

1. **LOOSE AND GRANULATED**
   (sometimes referred to as aggregate type)
2. **BATTS AND BLANKETS**
3. **BLOCKS AND BOARDS**
4. **PIPES, MOLDED**
   (flexible blankets are also used for pipe coverings)

Fig. 1 — General groups of insulations

The forms and shapes of commercial mass insulations are such as to work best with the methods of application and use adopted for a large number of projects. These have been evolved during the continuing increase in the use of insulations in buildings and industrial fields. While the form may be changed somewhat from time to time, the shapes are now, more or less, cataloged in recognized specifications of the *American Society for Testing Materials*, Federal agencies and commercial standards. The general groups are as listed in Fig. 1.

The structures of the manufactured insulating products differ one from another. Some have open cells while others have closed and sealed cells. Some are fibrous in nature with or without added binders. Some are masses having air entrained therein. Some are expanded by heat while others may be laminated.

ASBESTOS, 1200 F
LAMINATED PAPER, 700 F
CORRUGATED AND LAMIN. PAPER, 300 F
CALCIUM SILICATE, 1200 TO 1800 F
CERAMIC, 2500 F
CORKBOARD, BELOW 180 F
DIATOMACEOUS SILICA, 1500 TO 1900 F
GLASS, CELLULAR, 800 F
FIBROUS, SEE MINERAL WOOL
GYPSUM, CELLULAR, 900 F
MAGNESIA, 85 PERCENT, 600 F
MINERAL WOOL, ROCK, SLAG, GLASS
LOW TEMPERATURE, 450 F
HIGH TEMPERATURE, 1800 F
PLASTICS, FOAMED, 175 F
RUBBER, FOAMED, 150 F
VEGETABLE FIBERS — —
VERMICULITE, 1800 F

Fig. 2 — List of mass insulations

The accompanying list of mass insulations Fig. 2, may not be complete, but includes those materials which have arrived at sufficient prominence to warrant recognition in specifications by *ASTM* and Federal agencies. Particularly for industrial applications the recommended temperature limits are useful and therefore these values are included when this information is available.

Methods of Thermal Evaluation

It is frequently desirable to know the thermal conductivity, k, of insulating materials. These values may be determined by following appropriate recognized methods of *ASTM*. For flat homogeneous materials in a dry condition, the guarded hot-plate method, C-177, is useful. The ASHAE TAC on Insulation, has adopted a mean temperature of 75 F for the reporting of k values. Sometimes k values are published or advertised at lower mean temperatures, which values are lower than when they are determined at the base of 75 F. For homogeneous pipe insulations the conductivity can be determined in accordance with *ASTM* C-335.

Of growing interest is the *ASTM* tentative test method C 411-58T, for determining the performance of commercial sizes of both block and pipe forms of thermal insulating materials when exposed to simulated hot surface conditions. The method is applicable to hot surface temperatures in excess of 200 F.

Another new *ASTM* test method of growing importance is that for determining the thermal conductivity at low temperatures. It is applicable for mean temperatures between −250 and −150 F. This method is identified as *Wilkes Calorimeter* and, in all probabilities, will be adopted at the *ASTM* June 1958 Annual Meeting.

Calculation of Thermal Performance

Reference is made to Chapter 9 of the 1958 ASHAE GUIDE for calculation purposes.

Practical coefficients for Conductivities, k; Conductances, C; and Resistances, R, of Building and Insulating Materials are given in Table 4. The values are for design purposes and are based on many tests of a wide variety of materials.

Other tables in Chapter 9 show examples for calculation of Coefficient of Transmission, U, and values for a number of typical building constructions.

Thermal Performance on the Job

The thermal performance obtained on any job is dependent not alone upon the thermal conductivity of the insulating material or conductance in case of composite insulations. Although these properties are of prime importance other factors must be considered.

High on this list stands *workmanship* of the craftsman making the actual application. Does he follow explicitly the manufacturer's directions or does he do a poor job for some unexplained reason? Does he make satisfactory joints or does he leave wide open spaces?

The physical properties or characteristics of the insulation should also be considered. Are the expansion and/or contraction properties adequate to meet the extreme demands when hot or cold pipe lines are put into service following the application of the insulation at job ambient temperature? Do the materials absorb, hold or allow to pass through any water or moisture vapor which may get into them when performing under the operating conditions? Has the designer properly safeguarded the installation with such features as vapor barriers and ventilation?

These and many other questions about specific insulation materials may be asked by a competent designer.

Prefabricated Piping Systems

One cannot overlook the importance of commercially produced preassembled insulated piping systems for above or below ground use. In general these systems are designed for rapid and efficient field installing. They are completely engineered units of 20 or more feet in length and have the several pipes insulated and the assembly well vapor sealed. Field joints are at a minimum.

With increasing emphasis now being placed by the U. S. Armed Services on underground heating systems at their permanent bases, it is apparent that systems must be designed for not only the conservation of heat but also for the problem of physical ground water. In an area of flat terrain and in a prolonged rainy season, the ground water level may reach an elevation above the conduit system. In general two plans are followed: (1) insulated pipes are encased in watertight conduits constructed in the trenches and are provided with channels for draining off any entering water; (2) the piping is placed in position in the trench and surrounded with a mass consisting of an aggregate type insulation bonded with cementitious materials or asphaltic mastics.

Ducts

A growing application for insulations is that of lining air ducts. These blanket type linings may be either inside or outside of a metal duct. A second advantage to their use, besides thermal, is that of duct and fan noise reduction. Insulation boards having air erosion resistant surfaces are now finding their way into this field, eliminating the metal duct.

Conclusion

The success of any particular insulated building or industrial project is dependent upon the thermal properties of the insulating media, the thoroughness of the analysis of design and practical conditions, and, to a considerable degree, the efficiency of the workmanship in installing all parts of the structure.

Probe for Thermal Conductivity Measurement of Dry and Moist Materials

By W. Woodside*, Ottawa, Canada

SUMMARY—The development of the probe or transient *needle* method for thermal conductivity measurement is reviewed. The theory of the method, sources of error and an improved technique for recording the probe temperature rise are described. Experimental results for dry silica aerogel show good reproducibility and agreement with guarded hot plate measurements. Results for snow show a discontinuous variation of conductivity during test. The measured conductivity continuously decreased during tests on moist sawdust and moist clay, suggesting a loss of moisture from the specimen in the vicinity of the probe. This is verified by calculation of the moisture migration caused by the large temperature gradients at the probe surface. It is suggested that temperature gradients, and hence moisture redistribution, in probe tests may be reduced by increasing the probe radius, contrary to the present trend in probe development which is toward smaller probes.

THE TRANSIENT probe or needle method for the measurement of thermal conductivity was originated by Stalhane and Pyk in 1931[1]. It was later developed by Van der Held and Van Drunen[2] who applied the method to the determination of the thermal conductivity of liquids.

The method utilizes a line heat source, *i.e.*, a straight wire through which constant electric current may be passed and a temperature sensitive device, *e.g.*, a thermocouple or resistance thermometer. The 2 elements are embedded alongside each other in the material under test. When the assembly is at a uniform and constant temperature a constant power input is supplied to the heater element and the rise in temperature is recorded during a short heating interval. The rate of rise of temperature is determined by the ability of the test material to conduct heat away from the line heater. The thermal conductivity may be calculated from the temperature-time record and the power input.

The method was further developed by Hooper and Lepper[3] and Hooper and Chang[4] who enclosed the 2 elements in a protective aluminum tube 3/16-in. in diameter and approximately 19 in. in length. This was the first actual probe. The reproducibility of this instrument was said to be 0.5 percent, and it was stated that the probe could measure the conductivity of both dry and wet materials with equal facility and precision. De Vries[5] also described a probe suitable for measurement of thermal conductivity of soils *in situ*, and now the method is widely used for soil resistivity surveys along proposed routes for buried electric cables.

Van der Held and Van Drunen[2], Lentz[6], Vos[7] and Blackwell[8] have investigated errors in the probe method. The theory of the method is based on the assumption of a perfect line heat source of infinitesimal diameter, and hence errors arise due to the finite diameter of the probe. In an endeavour to reduce errors of this kind, to a negligible level, D'Eustachio and Schreiner[9] constructed a probe approximately 4 in. long with an outside diameter of 0.030 in. Results for dry materials were in good agreement with measurements made by the conventional guarded hot plate method. The probe used in the present work is similar to that used by D'Eustachio and Schreiner, but with an even larger length to diameter ratio.

Joy[10] used a thin probe to determine conductivities of 3 insulating materials at a variety of moisture contents and at 2 mean temperatures (89 and 8 F). Both thermocouple and resistance thermometer-type probes were used. Joy obtained reproducibility of ±1 percent for tests on dry materials, and ±6 percent for tests on moist materials. He concluded that the probe method is suitable when the test specimen is uniformly wetted. The resistance thermometer probe had more integrating ability than the thermocouple type in the cases of non-uniformly wetted specimens.

Mann and Forsyth[11] described the construction of 4-in. long probes using hypodermic needle tubing (0.055-in. outside diameter). More recently, Lachenbruch[12] described a probe, containing a thermistor as the temperature-sensing element, for use in the determination of thermal conductivity of frozen soils *in situ*. Saare and Wenner[13] investigated the effect of the radial position of the thermocouple inside the probe.

Experimental Procedure

The test material was placed, at the desired density, in an aluminum cylinder open at one end. The internal diameter of the cylinder was 6 in. and the internal height was 14.5 in. so that when the probe was inserted in the material at the axis of the cylinder, it was surrounded by 3 in. of material. The reference junction of the probe thermocouple was attached to the outer surface of the cylinder at mid-height. This assembly was placed centrally inside a larger cylinder of internal diameter 1 ft and height 2 ft. The annular space between the 2 cyl-

*Building Services Section, Division of Building Research, National Research Council.
[Exponent numerals refer to References.]
For presentation at the 65th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Philadelphia, Pa., January, 1959.

inders was filled with granulated rock wool insulation. To prevent gain or loss of moisture from the test material, the top of the cylinder was covered with polythene film.

The system was allowed to attain thermal equilibrium before each test. This is indicated by zero emf in the thermocouple circuit.

To take full advantage of the entire width of the recorder chart, a portable precision potentiometer was used to provide a constant bias emf in the thermocouple circuit. Thus the recorder operates as zero-right or zero-left instead of zero-centre. The initial temperature rise from 0 to 2 minutes was not used to calculate thermal conductivity. Since the greater part of the absolute temperature rise occurs during these first 2 minutes, it is convenient to use the potentiometer emf source to bias out the initial rise, increase the preamplifier gain by a factor of 4, and re-adjust the bias emf so that at approximately 1.8 min the recorder pen is at zero. With this procedure, used only in the more recent tests, the temperature-rise curve between 2 and 10 min after the start of the test, *i.e.*, the interval used for calculation of conductivity, is recorded on the full 9.5-in. width of the chart. This is possible since the calculation requires only the difference in temperature rises at two times, and not the absolute values of the rises. A typical recorder trace is shown in Fig. 1. Fig. 2 shows a recorder trace from a test in which the bias arrangement just described was used.

Experimental Results for Silica Aerogel

Dry silica aerogel was packed in the test container at a density of 5.20 lb per cu ft. Fig. 1 shows the recorder trace obtained from a test for which the heating current was $i = 10.99$ *mA*. The preamplifier gain was × 5 (scale multiplier × 40). The power input corresponding to this probe current is $Q = 0.3260$ watt per ft.

Fig. 3 shows the temperature rise θ plotted against $ln\ (t + t_o)$, t_o being −0.25 min. The results fall on a straight line for t as low as 0.5 min.

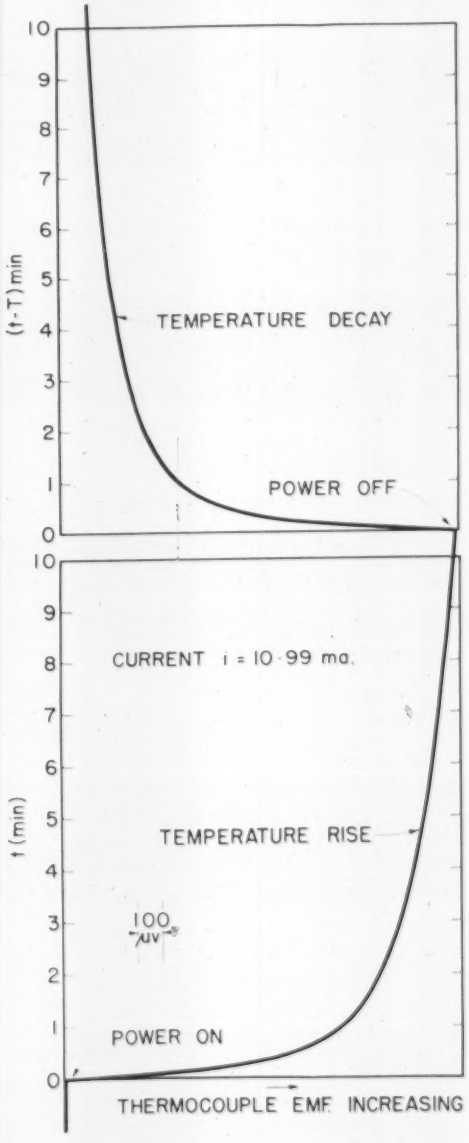


Fig. 1 — Recorder trace of probe temperature rise and decay for test on dry silica aerogel

The slope of the straight line (temperature-rise data) is 5.325, giving a value for k of 0.199$_5$ Btu in. per (hr) (sq ft) (F deg). In this test the power was switched off at time $t = T = 10.5$ min, and the temperature decay was also recorded. From the extra-polated temperature-rise data, values of $[(Q/4\pi k)[C' + ln\ (t + t_o)] - \theta]$ were plotted against $[ln\ (t - T + t_o)]$, (Fig. 3). The 2 sets of results are almost superimposed.

The slope of the straight line (temperature-decay data) is 5.410, and the calculated thermal conductivity is 0.196$_3$ Btu in. per (hr) (sq ft) (F deg) agreeing very well with the conductivity determined from the temperature-rise data. The lower conductivity for the decay curve may be partly

explained by the lower mean temperature during the measurement interval of the decay curve.

Tests were also performed on silica aerogel with different power inputs. The results are shown in Table 1. The measured conductivities in the second column of the table were calculated from Equation*[A-4] between

Table 1 — Variation of measured conductivity with power input

Power input Q, watt/ft	Measured conductivity Btu in./hr (sq ft) (F)	Mean Temperature, F	Max. temp. gradient at probe surface, F deg per in.
0.00366	0.165	70.6	13.7
0.00632	0.169	71.0	23.5
0.01400	0.185	72.1	52.2
0.02927	0.186	74.2	109.1
0.05168	0.190	77.3	192.6
0.3260	0.199s	129.4	1214.0

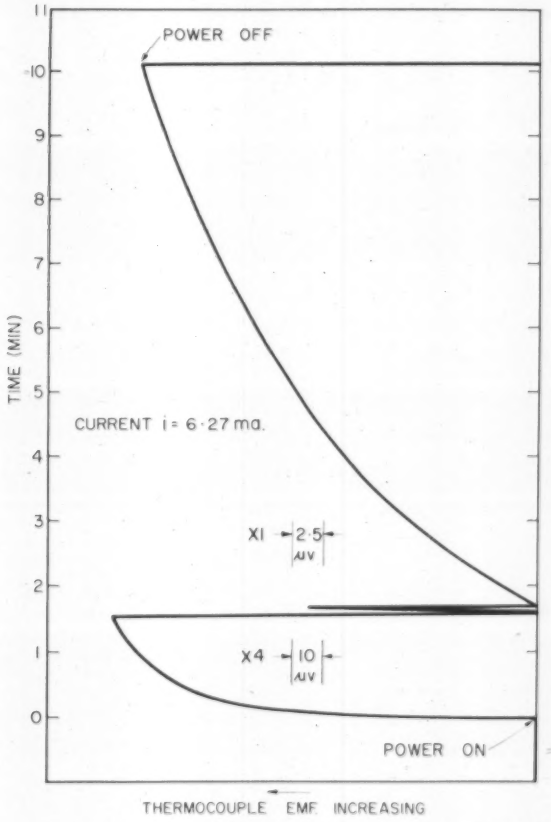


Fig. 2 — Recorder trace obtained with use of bias emf.

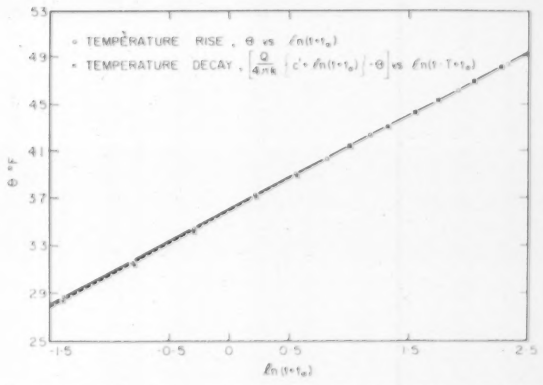


Fig. 3 — Temperature rise and decay plotted against the logarithm of the time for test on silica aerogel

times of 2 and 10 min. The values shown are the averages of 7 values calculated during this time interval. The mean temperatures shown in the third column are calculated, assuming an initial temperature of 70 F, and taking the average of the temperature rises at 2 and 10 min.

*Equation A-4 is developed in the Appendix, and is $k = 0.64\gamma_2 \{r^2 \log [(t_2 - 0.25)/(t_1 - 0.25)]\}/(V_2 - V_1)$. In the Appendix also are Equations A-1, A-2, A-3 and A-5. It is planned to publish the Appendix with the paper in the TRANSACTIONS.

Conductivity of silica aerogel at 70 F and density of 5.57 lb per cu ft has also been measured with an 8- by 8-in. guarded hot-plate apparatus, the value being 0.167 in good agreement with the probe values 0.165 and 0.169 (Table 1).

The increase in measured conductivity with increasing power input may at least be partly attributed to the increase in mean temperature. However the increase is much greater than that normally experienced with guarded hot plate measurements. Van der Held has also observed that in the case of materials easily penetrated by thermal radiation, thermal conductivities measured by a transient method such as the probe are higher than conductivities measured by steady-state methods. In a series of papers[14, 15, 16] Van der Held has discussed the contribution of radiation to heat transfer in materials under both transient and steady-state conditions. It appears therefore that radiative heat transfer in silica aerogel

Nomenclature

θ = temperature rise of probe, Fahrenheit.
Q = probe heat input per unit length, Btu per (hour) (foot).
r = radial distance from probe axis, feet.
r_0 = probe radius, feet.
t = time from start of heating, hour.
T = duration of probe heating, hour.
t_0 = probe time correction, hour.
τ = time for complete drying of volume element of specimen adjacent to probe, hour.
V = probe thermocouple emf corresponding to temperature rise, microvolts.
i = probe heating current, milli-amperes.
p = water vapor pressure in pores of specimen, inches mercury.
k = thermal conductivity of test specimen, Btu per (hour) (foot) (Fahrenheit degree).
α = thermal diffusivity of test specimen, square feet per hour.
ρ = dry density of test specimen, pounds per cubic foot.
c' = specific heat of test specimen, Btu per (pound) (Fahrenheit degree).
μ = water vapor permeability of test specimen pounds per (hour) (foot) (inches mercury).
m = initial moisture content of test specimen, fraction of dry weight.

is appreciable under transient conditions.

Thermal diffusivity α of the test specimen may be estimated from the probe data, providing the effective radial distance, r, between the probe heater and thermocouple is known. It will be assumed that $r = 0.01$ in. (outside diameter of probe = 0.020 in.). From Fig. 3, it may be seen that when $ln\ (t + t_0) = 0$,

$$\theta = (Q/4\pi k)\ C' = 36.00$$

since

$$Q/4\pi k = 5.325,\ C' = 6.76$$

but

$$C' = -0.577 - ln\ (r^2/4\alpha),$$

therefore

$$r^2/4\alpha = 6.51 \times 10^{-4},$$

and

$$\alpha = 0.016 \text{ sq ft per hr.}$$

Wilkes and Wood[17] give for silica aerogel at 147 F a value for α of 0.020 sq ft per hr, the density ρ being 4.0 lb per cu ft. Since the density in the probe tests was 5.2 lb per cu ft, and $\alpha = k/\rho c$ the probe diffusivity value agrees well with the value given by Wilkes and Wood.

Experimental Results for Moist Sawdust

Several experiments were performed on moist sawdust with the probe, the moisture content and the probe power input being varied. Equation A-4 for the calculation of thermal conductivity from probe data is based upon heat conduction theory. It is known that heat transfer processes other than pure conduction occur in moist porous materials under a temperature gradient. However, it is assumed that the equation may be applied to the calculation of an effective thermal conductivity in the case of moist materials. In the tests on moist sawdust, the measured conductivity was found to vary during the time of the test. Fig. 4 shows a typical plot of conductivity *vs.* time after start of test. The conductivities shown on this graph are those calculated for times 0.5 to 1.0 min, 1.0 to 1.5 min, 2.0 to 3.0 min, 3.0 to 4.0 min, and so on. The conductivity apparently has a high initial value, quickly falling to a more or less constant value. This effect may be caused by the partial drying out of the test specimen in the immediate vicinity of the probe. Results are shown in Table 2. The conductivities tabulated are average values for the interval 2.0 to 10.0 min.

Experimental Results for Snow

For this series of tests, the test assembly was placed in a cold room[18], the probe power and thermocouple leads being taken out to an adjacent laboratory where the auxiliary equipment was situated. During the majority of these tests, the cold room was operated at a temperature of +15 F; the power input to the probe was limited in order that the temperature rise at the probe should not exceed 10 F deg.

Snow was first passed through a No. 6 sieve (opening 0.131 in.) and then placed in the test cylinder at a density of 17.83 lb per cu ft (0.286 gm per cc). Results of the tests on snow are shown in Table 3.

The measured conductivity varied appreciably from one test to the next, and also during the course of a single test. The measured conductivities reported in the last column of the table are the averages of 7 values calculated during the interval between 2 and 10 min from the beginning of each test. The initial temperatures given in the first column of the table are the air temperatures in the cold room during each test.

Table 2 — Conductivity results for sawdust

Dry density lb per cu ft	Moisture content % dry wt	Power input watt per ft	Mean temp F	Measured conductivity Btu in. per (hr) (sq ft) (F deg)
15.00	3.14	0.1017	78.2	0.468
15.00	3.14	0.2425	88.5	0.471
15.00	3.14	0.5330	103.0	0.479
15.00	6.52	0.1186	79.0	0.505
15.00	6.52	0.2651	87.0	0.505
15.00	6.52	0.5858	105.0	0.508
15.84	12.8	0.1065	77.0	0.649
15.84	12.8	0.3223	85.4	0.655
15.84	12.8	0.7795	107.0	0.621

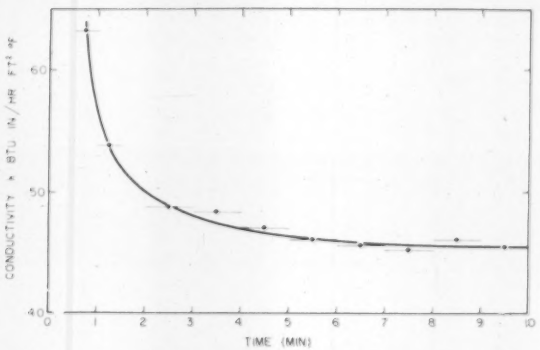


Fig. 4 — Variation of measured thermal conductivity with time during probe test on moist sawdust

Table 3 — Thermal conductivity of snow (0.286 gm per cc at different temperatures)

Initial temp F deg	Power input watt per ft	Temperature rise F deg	Maximum temp gradient F deg per in.	Measured conductivity Btu in. per (hr) (sq ft) (F deg)	
+15	0.242	6.0	110	1.514	
+15	0.054	1.5	27	1.391	
+15	0.054	1.5	27	1.541	Mean
+15	0.257	6.0	110	1.59	1.41
+15	0.329	7.5	161	1.40	
+15	0.270	6.0	185	1.01	
− 5	0.257	6.0	110	1.16	1.50
− 5	0.542	13.5	202	1.84	
−35	0.229	5.0	99	1.61	1.62
−35	0.251	5.0	99	1.65	

On averaging the conductivities obtained for the several tests at each temperature, the results indicate that the thermal conductivity of snow increases with decreasing temperature. Jakob[19] reports that the thermal conductivity of ice increases with decreasing temperature, and is 15.5 Btu in. per (hr) (sq ft) (F deg) at

32 F, 17.3 at −13 F, and 19.2 at −58 F. Thus, although the effective thermal conductivity of the air in the pore spaces in snow decreases with decreasing temperature, the net effect is an increase in the conductivity of snow with decreasing temperatures.

In the probe tests on moist sawdust the measured conductivity varied continuously with time during test. A variation in conductivity during test was also observed in the tests on snow; the variation was discontinuous, however. Fig. 5 shows the microvolt reading of the probe thermocouple plotted against log $(t + t_o)$ for a probe test on snow which was allowed to run for 25 min instead of the usual 10. For a normal material this graph would be a straight line, (e.g., Fig. 3 for silica aerogel) the slope of which determines the thermal conductivity. In the present case, 3 straight lines each of a different slope, may be drawn through the test data. This corresponds to 3 different values of thermal conductivity: from 1.8 to 4.5 min $k = 1.21$; from 4.5 to 14.7 min $k = 1.85$; and from 14.7 to 25 min $k = 1.16$ Btu in. per (hr) (sq ft) (F deg). The times when a change in conductivity occurs are not the same from one test to the next and, as is evident from Fig. 5, the transition from one value of conductivity to another appears to be a sharp one.

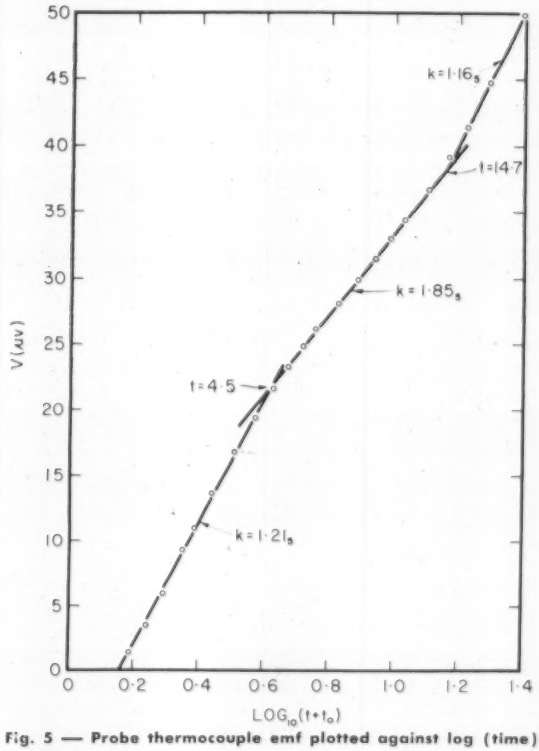


Fig. 5 — Probe thermocouple emf plotted against log (time) for test on snow

Yosida[20] observed this same phenomenon during measurements of the thermal conductivity of snow, the method of measurement being very different from the one described here. The tests lasted about 30 min. Yosida attributed these changes in conductivity to changes in the snow structure brought about by the heat flow through the snow.

The thermal diffusivity α also may be calculated from the conductivity values shown in Table 3. The values of α range between 0.0132 and 0.0151 sq ft per hr.

Experimental Results for Moist Leda Clay

Results of probe measurements on dry Leda clay are reported by Woodside and de Bruyn[21]. Two measurements were made on Leda clay at a moisture content of 10.2 percent by dry weight, the dry density being 61.4 lb per cu ft. The average measured conductivities were 1.16 and 1.17 Btu in. per (hr) (sq ft) (F deg). The variation of measured conductivity with time for these 2 measurements is shown in Fig. 6.

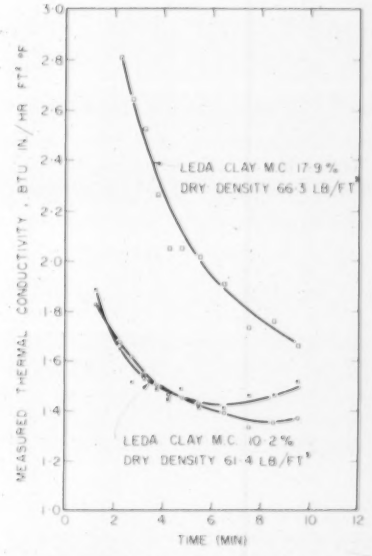


Fig. 6 — Variation of measured thermal conductivity with time during probe tests on moist Leda clay

Five measurements were performed on Leda clay at a moisture content of 17.9 percent by dry weight, the dry density being 61.4 lb per cu ft. The average measured conductivities varied from 1.52 to 2.13 Btu in. per (hr) (sq ft) (F deg), the conductivity apparently increasing from one test to the next. An example of the very large variation in conductivity during the course of a single test is shown in Fig. 6.

Discussion

Probe measurements on dry materials: The thermal conductivity probe method appears to be satisfactory for measurements on dry materials. The tests performed on dry silica aerogel gave results with excellent reproducibility, in good agreement with guarded hot plate data.

Several advantages of the probe method over the conventional guarded hot plate method are apparent. Testing time is of the order of 15 min compared with at least 24 hr for normal hot plate measurements. This does not mean, however, that 4 tests may be performed in 1 hr since the sample must be allowed to attain thermal equilibrium before the start of each test. The thermal diffusivity of the specimen may be estimated from probe data provided that the radial distance between thermocouple and heater is known.

Probe measurements may be performed with little auxiliary equipment, the basic necessities being a storage battery, portable potentiometer, stop watch and dewar flask. However, the measurements are more accurate and more convenient when a recording potentiometer with preamplifier and a variable bias emf source, such as those described, are available. Compared with guarded hot plate equipment, the apparatus is compact, portable and relatively inexpensive. In some instances, probe measurements might be performed on a test material *in situ*.

Tests may be performed with only a small temperature rise; for example, the temperature rise in several of the tests on silica aerogel was less than 1 F. This is an advantage for determining the thermal conductivity of materials at different mean temperatures, especially when the k *vs* temperature variation is nonlinear. In the guarded hot plate, temperature differences of 30 to 40 F are normally applied across the specimens.

All the tests described in this paper have been performed on granular materials, and as the probe was easily inserted good thermal contact was obtained. In the case of non-granular materials, *e.g.*, wood, concrete, and fibrous insulation, it would be more difficult to obtain good thermal contact. Also many insulating materials are anisotropic, *e.g.*, wood, fiberboard, and many rock wool batt insulations. Such materials have vastly different thermal conductivities in directions parallel to and perpendicular to the *grain* or plane in which most of the fibers are oriented. Since the probe is a radial heat flow method, such materials introduce special problems. Specimens may be arranged so that tests may be performed first with the probe perpendicular (k_1) to the direction of the fibers of the material and, secondly, with it parallel (k_2) to the fiber direction. The conductivity k for heat flow perpendicular to the plane in which the fibers are oriented is then $k = (k_2)^2/k_1$. This procedure has been successfully applied to fiberboard by Joy[10].

The length to diameter ratio of a probe should be high so that the instrument approximates an ideal line heat source. Large probes require large specimens, however, and small probes tend to be comparable in diameter to the particles or cells of some porous materials.

Probe measurements on moist materials: In the determination of the thermal conductivity of moist materials, many problems arise. Most investigators in this field realize that moisture movement is not eliminated in probe measurements[10] but assume that the moisture redistribution during the short testing interval is negligible[3, 4, 5, 9]. For example, Hooper and Lepper[3] have stated that examination of the specimens following test indicated no substantial alteration in the moisture distribution. This is in marked contrast to measurements on moist materials with the guarded hot plate apparatus and other steady-state methods for measuring conductivity[21, 22, 23]. If a moisture redistribution should develop during a probe test, however, it would be difficult to detect since the greater part of the moisture content gradient would occur close to the probe surface.

The decrease in measured conductivity with time during the test interval, which was observed in the tests on moist sawdust and moist clay, indicates that (*a*) some drying out of the specimen close to the probe does occur; and/or (*b*) application of the heat conduction theory to the heat transfer mechanism which occurs in moist porous media is not justified.

Since the layers of test specimen close to the probe have the largest effect on the conductivity measured by the probe, any drying out of these layers would produce a large decrease in the measured conductivity. It would seem to be of interest, therefore, to calculate the rate of vapor flow induced by the temperature gradient. Such a calculation of necessity involves several assumptions and approximations.

The water vapor flow is given by the equation (Fick's law) $W = -\mu A\, dp/dr$, where μ is the vapor permeability of the specimen, A is the effective area for flow, and (dp/dr) is the vapor pressure gradient in the pore spaces of the specimen. Consider an element of test specimen in the shape of a concentric cylindrical shell surrounding the probe, of unit length and radius r. Both A and (dp/dr) will be evaluated at the outer surface of this shell. Thus $A = 2\pi \cdot r$.

Now

$$dp/dr = (d\theta/dr)\ (dp/d\theta)$$

But by Equation A-5 the steady-state temperature gradient is

$$d\theta/dr = -Q/2\pi rk$$

This is the overall temperature gradient in the material at radius r. The temperature gradient in the pore spaces of the material, however, may

be many times greater than this overall gradient[24, 25], and it is the gradient in the pores which determines the corresponding vapor pressure gradient. For the present purpose, however, the overall gradient will be used. Therefore,

$$W = \mu\, 2\pi r\, (Q/2\pi rk)\, (dp/d\theta) = \mu\, (Q/k)\, (dp/d\theta)$$

The initial weight of moisture contained in the volume element is

$$M = \pi\, (r^2 - r_o^2)\, \rho\, m$$

where r_o is the probe radius, ρ is the dry density of the test specimen, and m is the initial moisture content of the specimen expressed as a fraction of the dry weight.

Thus the time τ required to dry out completely the volume element considered is

$$\tau = M/W = [\pi\, (r^2 - r_o^2)\, \rho\, m\, k]/[\mu\, Q\, (dp/d\theta)]$$

If a volume element of radius $2r_o$ is considered,

$$\tau = [3\, \pi\, r_o^2\, \rho\, m\, k]/\, [\mu\, Q\, (dp/d\theta)] \quad ..(1)$$

This equation is now applied to the probe test on Leda clay with 10.2 percent moisture content by dry weight and 61.4 lb per cu ft dry density. The variation of measured conductivity with time for this test is shown in Fig. 6, and $r_o = 0.01$ in., $m = 0.102$, $\rho = 61.4$ lb per cu ft. The vapor permeability μ of this clay was measured by the dry cup test, yielding a value for μ of 33.9 perm. in. (grains in. per (hr) (sq ft) (in. Hg). If the relative humidity within the pores of the clay is 100 percent at 85 F which is the mean temperature of the probe test, then

$$(dp/d\theta) = 0.0394, \text{ in. Hg per F deg}$$

Substituting these values in Equation 1, the value for τ is found to be 10.8 min. Thus the first layer of clay (of thickness equal to the probe radius) should lose all its moisture in approximately 11 min., and hence the measured thermal conductivity should decrease appreciably during the 10-min. test interval, as was observed.

Since the foregoing calculation leads to a conclusion contrary to the view now held by many workers in this field, the assumptions involved in the calculation are re-examined.

1. It was assumed that the steady-state temperature gradient is applied instantaneously and maintained during the test. The gradient at the probe surface is essentially the steady-state gradient as soon as the higher terms in the $I(x)$ series may be neglected, which is after 0.5 min for the probe described.

2. The calculation neglected the fact that as the volume element dries out, the relative humidity and hence the vapor pressure in the pores, decreases, thus reducing the flow.

3. It has been assumed that the only mechanism for moisture flow is thermally actuated vapor diffusion. Capillary forces, however, may tend to return liquid moisture to the drying regions.

4. Finally, as stated before, the temperature and vapor pressure gradients in the pore spaces may be several times higher than the corresponding overall gradients.

The effects due to 1, 2 and 3 tend to be wholly or partially compensated for by 4, so that the calculation leads to a result which is at least correct to an order of magnitude.

It may be concluded, therefore, that in some instances thermal conductivity probe measurements may produce moisture content gradients in the vicinity of the probe just as severe as those produced by steady-state hot plate measurements. In measuring thermal conductivity of moist materials, the probe sets up large temperature gradients for a short duration, whereas the guarded hot plate imposes relatively low gradients for a long duration. The ideal method, which would maintain as uniform a moisture distribution as possible, would appear to be one which is fast and uses small temperature gradients.

Equation 1 indicates that τ will be small, and hence the moisture content gradients set up will be large, when (*a*) probe radius is small; (*b*) power input to the probe is large; (*c*) mean temperature is high (*i.e.*, when $dp/d\theta$ is large); and (*d*) conductivity of the test specimen is small.

Factors (*a*), (*b*) and (*d*) also lead to high temperature gradients in the specimen. Thus it appears that moisture content redistribution in probe tests may be reduced by increasing the size of the probe and by using smaller power inputs.

From the point of view of probe design, the theory requires that the probe radius be as small as possible; for testing moist materials, however, it appears desirable that the probe radius be large. Thus the recent trend in probe development towards smaller probe diameters (large length to diameter ratios) appears to be in the wrong direction for the testing of moist materials.

Conclusions

1. It has been shown that the temperature gradients set up in the vicinity of a thin probe during test are exceedingly high, being of the order of hundreds of Fahrenheit degrees per inch.

2. The results of probe tests on dry silica aerogel have shown that both reproducibility and agreement with guarded hot plate results are good (better than 1 percent) when low probe power inputs are used.

3. Results of tests on moist sawdust have shown a steady decrease in measured conductivity during the 10-min test interval.

4. Results of tests on snow have shown a variation in measured thermal conductivity during test similar to that observed by Yosida who used an entirely different method of measurement.

5. In tests on moist clay, a steady decrease in measured conductivity during test was observed.

6. The probe method appears satisfactory for dry materials. The steady decrease in measured conductivity during test observed in the measurements on moist sawdust and moist clay suggests a steady drying out of the material in the vicinity of the probe.

7. A rough calculation indicates that in the test on 10 percent moisture content clay, a layer of clay equal

in thickness to the probe radius, should completely dry out during the short 10-min test. Thus the moisture redistribution during test does not appear to be negligible as is commonly assumed, at least for tests using thin probes.

8. One way by which the temperature gradients and hence moisture redistribution in probe tests, may be reduced is to increase the probe radius, contrary to the present trend in probe development which is toward smaller and smaller probe sizes. Since errors due to the finite size of a probe may be corrected for, it would seem advantageous to use larger probes and avoid some of the difficulties in testing moist materials.

Acknowledgments

This paper is a contribution from the Division of Building Research, National Research Council, Canada and is published with the approval of the director of the Division. The author wishes to thank N. B. Hutcheon and A. G. Wilson for many helpful discussions.

References

1. New Method for Determining the Coefficients of Thermal Conductivity, by B. Stalhane and S. Pyk (*Teknisk Tidskift*, 61 (28), 1931, pp. 389-93).

2. A Method of Measuring the Thermal Conductivity of Liquids, by E. M. F. Van der Held and F. G. Van Drunen (*Physica*, 15, 1949, pp. 865-881).

3. Transient Heat Flow Apparatus for the Determination of Thermal Conductivities, by F. C. Hooper and F. R. Lepper (ASHVE TRANSACTIONS, Vol. 56, 1950, pp. 309-324).

4. Development of the Thermal Conductivity Probe, by F. C. Hooper and S. C. Chang (ASHVE TRANSACTIONS, Vol. 59, 1953, pp. 463-472).

5. A Non-Stationary Method for Determining Thermal Conductivity of Soil *in Situ*, by D. A. de Vries (*Soil Science*, Vol. 73, No. 2, 1952, pp. 83-89).

6. A Transient Heat Flow Method of Determining Thermal Conductivity. Application to Insulating Materials by C. P. Lentz (*Canadian Journal of Technology*, 30, 1952, pp. 153-166).

7. Measurements of Thermal Conductivity by a Non Steady State Method, by B. H. Vos (*Applied Science Research*, A, 5, 1955, p. 425).

8. The Axial Flow Error in the Thermal Conductivity Probe, by J. H. Blackwell (*Canadian Journal of Physics*, Vol. 34, No. 4, 1956, p. 412).

9. A Study of a Transient Method for Measuring Thermal Conductivity, by D. D'Eustachio and R. E. Schreiner (ASHVE TRANSACTIONS, Vol. 58, 1952, pp. 331-342).

10. Thermal Conductivity of Insulation Containing Moisture, by F. A. Joy (*ASTM Special Technical Publication* No. 217, 1957).

11. Measurement of the Thermal Conductivity of Samples of Thermal Insulating Materials and of Insulation in Situ by the *Heated Probe* Method, by G. Mann and F. G. E. Forsyth *Modern Refrigeration*, June 1956, pp. 188-191).

12. A Probe for Measurement of Thermal Conductivity of Frozen Soils in Place by A. H. Lachenbruch (*Transactions, American Geophysical Union*, Vol. 38, No. 5, October 1957, pp. 691-697).

13. Varmeledningstal Hos Olika Jordarter, by E. Saare och C. G. Wenner (*Handlingar Nr.* 31, Statens Namnd For Byggnadsforskning, Stockholm, August 1957; (In Swedish, with English summary).

14. The Contribution of Radiation to the Conduction of Heat, by E. F. M. Van der Held (*Applied Scientific Research*, Section A, Vol. 3, 1952, pp. 237-249).

15. The Contribution of Radiation to the Conduction of Heat, II Boundary Conditions, by E. F. M. Van der Held (*Applied Scientific Research*, Section A, Vol. 4, 1953, pp. 77-99).

16. The Contribution of Radiation to Heat Conduction, by E.F.M. Van der Held. Centraal Technisch Instituut T.N.O. Delft, Afdeling Warmtetechniek, Verslag 37, 1955, 8 p). Translation available from National Research Council of Canada, Ottawa, as *Technical Translation* TT.626, 1956.

17. The Specific Heat of Thermal Insulators by G. B. Wilkes and C. O. Wood (ASHVE TRANSACTIONS, Vol. 48, 1942, p. 493).

18. New Snow and Ice Research Laboratory in Canada, by L. W. Gold (*Journal of Glaciology*, Vol. 2, No. 19, March 1956, pp. 635-637, & NRC 3852).

19. *Heat Transfer*, by M. Jakob (John Wiley & Sons, Inc., 1949, Vol. 1, p. 97).

20. Physical Studies on Deposited Snow. I. Thermal Properties by Z. Yosida et al (*Institute of Low Temperature Science*, Hokkaido University, Sapporo, Japan, Contribution no. 7, 1955, pp. 19-74).

21. Heat Transfer in a Moist Clay, by W. Woodside and C.M.A. de Bruyn (to be published).

22. Moisture Migration in a Closed Guarded Hot Plate, by N. B. Hutcheon and J. A. Paxton (ASHVE TRANSACTIONS, Vol. 58, 1952, pp. 301-320).

23. Heat and Moisture Transfer in Closed Moist Soil Systems by W. Woodside and J. B. Cliffe (to be published).

24. Moisture Movement in Porous Materials under Temperature Gradients, by J. R. Philip and D. A. deVries (*Transactions, American Geophysical Union*, Vol. 38, No. 2, April 1957, pp. 222-32).

25. Effect of Temperature Distribution on Moisture Flow in Porous Materials, by W. Woodside and J. M. Kuzmak (Submitted to *Transactions, American Geophysical Union*) (in Press, August, 1958).

CM

Bulletin on CONDENSING METHODS

If there is sufficient interest it is likely that a Special Bulletin, to contain the 5 papers presented at the Symposium on CONDENSING METHODS at the Semi-Annual Meeting, June 25, 1958, will be prepared as a service to members. In order to assist in the decision please indicate your needs in connection with such a bulletin.

I need ..... copies.
You may invoice me at $1.50 each, postpaid.

Cut on dotted line and mail to:

ASHAE, 62 Worth St., New York 13, N.Y.

NAME (type or print)

Street Address

City Zone State

Frost Formation and Heat Transfer on a Cylinder Surface in Humid Air Cross Flow

Part I — Experimental Study

By P. M. Chung* and A. B. Algren**, Minneapolis, Minn.

SUMMARY—The effect of frost formation on the heat transfer between a humid air stream and a cylinder was studied both experimentally and theoretically. This was done with the hope that it would give some fundamental insight to understanding the performance of an evaporator coil under frosting conditions. The following studies were made experimentally and are reported in Part I: (1) steady-state heat and mass transfer; (2) variation of heat and mass transfer with respect to time.

In Part II these items are studied theoretically and correlations are made between the theoretically developed equations and the experimental data. The attempt is made to find the major parameters which influence the processes. Also in Part II, the diffusional process within the deposited frost itself, is studied theoretically.

THE HEAT and mass transfer processes between humid air and a solid surface kept at a subfreezing temperature have become common phenomena with application of low temperature refrigeration.

Major existing investigation of the problem of heat transfer and frost formation pertinent to the present study are included in References 1 through 14.

The investigations reported in many of the references were concerned with the overall effect of an evaporator frosting on the performance of a refrigeration system. Experimental performance data for a frosted evaporator coil are given in some of the papers, whereas information obtained through experiences in application are found in others.

In several of the References (1, 6, 9, 10, 11, 13 and 14) the basic analytical studies on heat transfer and frost formation were conducted both theoretically and experimentally. The particular problems analyzed in the referenced papers included free convection, and forced convection over a flat plate.

In 1933, Piening[9] carried out one of the first analytical studies, by forming ice on a cylinder from a natural convection current of humid air. Since then, several people, listed in the references, studied the mechanism of heat transfer accompanied by frost formation essentially on a flat plate.

The latest study on the subject is found in the work of Sugawara and his associates[14]. Frost was formed on a 15-cm × 100-cm brine-chilled flat plate as a stream of controlled humid air passed over it. Air velocities of 1.5- to 7.1-meters per sec were used. Typical data obtained from the experiment are reproduced here in Fig. 1. It is seen from Fig. 1 that the total heat transfer rate decreased with time, and reached quasi-steady state in 60 to 80 min.

Virtually no basic analytical work in connection with forced convection across a tube has been reported.

For an engineering purpose, the transfer process between the humid air and a circular tube in cross flow is probably more important than the process over a flat plate. In the absence of previous work, this particular phase of the subject was studied.

Experimental Set-Up

Test Cylinder No. 1: It was decided in the heat transfer studies to evaporate a refrigerant in the test section rather than to pass chilled brine through it so that uniform temperatures may be obtained on the test surface without sacrificing accuracy of measurement. Measurement of mass of refrigerant evaporated per unit time then can be used to calculate heat transfer.

Test cylinder No. 1 was constructed with the previously stated principle in mind in order to measure local heat transfer along the circumference

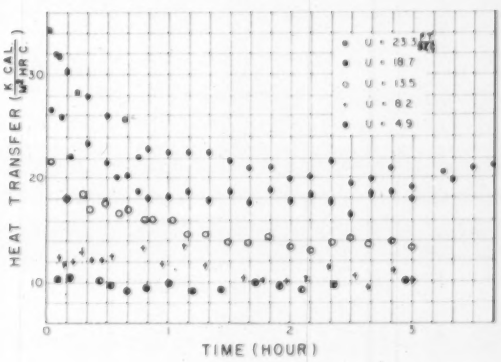


Fig. 1 — Variation of total heat transfer with time, reproduced from Reference 14

*Assistant Professor, Department of Mechanical Engineering, University of Minnesota.

**Professor, Department of Mechanical Engineering, University of Minnesota. Member of ASHAE.

[1]Exponent numerals refer to References.

For presentation at the 65th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Philadelphia, Pa., January 1959.

of the cylinder for any given time. Actual design and construction were quite complicated. Fig. 2 is a sketch of the internal structure of the cylinder. The cylinder which is 1⅛ in. OD and 2 ft in overall length, is made of copper, and divided into test and guard sections. The test surface is 1 ft long and has surface area of 0.0273 sq ft. The test section and guard section are separated from each other by 0.1-in. air gap all the way around except at the cylinder surface. A 1/16-in. diam rubber O-ring was split in half and fitted into the gap along the borderline between the test and guard surfaces. Wax was then poured over it to make it tight. The rubber ring and wax were fitted into the gap to a depth of about 1/16 in. and the excess portion above the cylinder surface was filed to a smooth surface. The test and guard sections have separate refrigerant passages in and out.

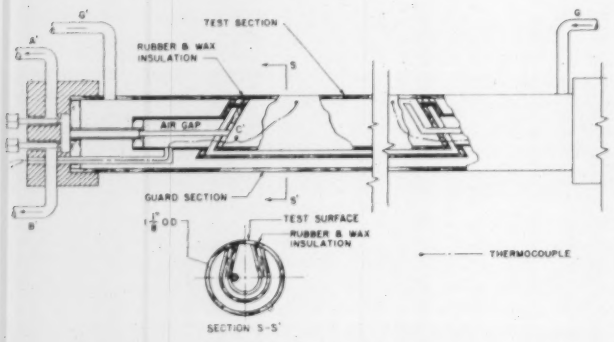


Fig. 2 — Test Cylinder No. 1 for heat transfer test

Four thermocouples were led into the test cylinder, 2 from each end. One set was soldered to the test section and the other to the guard section. To measure the temperature of the test surface accurately, the thermocouples should be connected to the surface. However, it was impossible practically to pass the thermocouples through the bottom of the test section and reach the test surface from below. The thermocouples, therefore, were soldered to the side of the test section exposed to the air gap. It was thought, that since the thermocouples were located very close to the test surface and the surface would be in direct contact with the evaporating refrigerant liquid during the tests, the temperature of the test section measured would represent the test surface temperature without appreciable error. A very thin coat of white enamel was put on the surface of the cylinder to lessen the error in heat transfer measurement which might be caused by variation of surface emissivity with frost formation. The white enamel was known to have an emissivity of 0.92 whereas the emissivity of frost is 0.98 (Reference 15). Possible effect of the enamel on frost formation was tested and found to be negligible. A photograph of the assembled cylinder No. 1 is shown as Fig. 3.

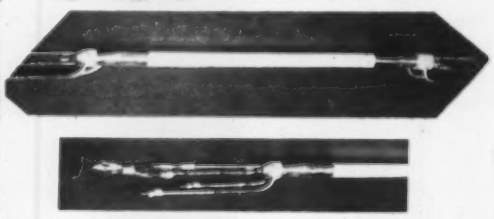


Fig. 3 — Photos showing the assembled Cylinder No. 1

Test Cylinder No. 2: The second cylinder was made to measure the mass transferred to the surface. Cylinder No. 2 measured 1 in. OD and 2 ft in overall length. Fig. 4 is a sketch of the cylinder structure.

Three thermocouples were led into the cylinder from one end, and each one was connected to the test surface. The 3 thermocouples were located along the circumference of the cylinder at equal distances apart. As shown in Fig. 4, refrigerant is passed through the annular space between the outer cylinder and the inner tube. Three dividers were placed longitudinally in the annular space to insure uniform distribution of refrigerant through the space. A thin coat of white enamel was put on the completed cylinder similar to No. 1.

Test Room and Wind Tunnel: A low-speed wind tunnel was constructed and installed (Fig. 5) in a temperature and humidity controlled test room (15- × 16- × 9-ft). The inside of the tunnel at the test section measured 10 × 20 in. Air flow was created by a turbo-blower driven by a 5-hp electric motor. The blower was rated for 1300 cfm delivery against a static pressure of 1 in. Hg. Air flow rate was controlled by a damper at the discharge of the blower.

Air sucked through the intake nozzle from the test room was discharged from the blower directly into one of 2 return plenums in the rooms. The air, conditioned for both temperature and humidity was returned to the room uniformly through the perforated ceiling air supply panel by a separate blower. Smoke was generated in the test room and its motion, observed during a test, showed that the air turbulence level in the room was not higher than that in an average room.

Measurements

Free Stream Velocities at the Test Section: At higher air velocities, pitot

tube traverses were made across the test section. Pressures were measured with a micromanometer with vernier scale attachment graduated to 0.001 in. of water. Fig. 6 shows the typical velocity profile across the test section.

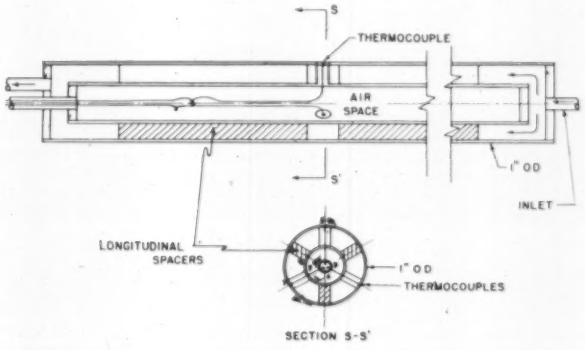


Fig. 4 — Test Cylinder No. 2 for mass transfer test

The average free stream velocities were obtained as a function of the corresponding pressure drop across a 4-in. flow nozzle located downstream.

For lower air velocities the local velocities at the test section could not be measured accurately. However, the 4-in. flow nozzle used in the experiment had been calibrated previously and very accurate calibration data of air flow *vs* pressure drop across the nozzle were available. Therefore, measured values of the mass flow of air were used in the following manner to calculate the free stream velocity at the test section. The simplified equation (Equation 1) is given in Reference 16 for the boundary layer development along the surface of a body with an arbitrary pressure gradient.

$$\frac{U_s l_i^*}{\frac{\mu}{\rho}} = \frac{0.47}{\left(\frac{U_s}{U_o}\right)^5} \int_0^x \left(\frac{U_s}{U_o}\right)^5 dx \qquad (1)$$

Equation 1 was integrated numerically from the beginning of the intake nozzle to the test section for a given mass flow rate. This yielded the momentum thickness l_i at the test section. Solution of a boundary layer equation at $du_s/dx = 0$ such as at the test section gave $l^*/l_i = 2.554$ (Reference 16). Therefore, the displacement thickness l^* was obtained from l_i. Each surface at the test section was then assumed to have moved inward by l^*. Finally, by definition of displacement thickness, a free stream velocity for a given measured mass flow was obtained by dividing the total volume flow by the corresponding decreased hypothetical cross-sectional area at the test section.

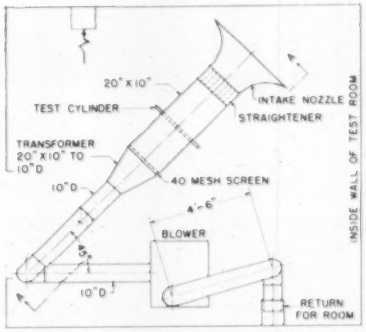


Fig. 5 — Wind tunnel in test room

Stream velocities thus obtained were further corrected to cover the blockage created by the test cylinder. Equation 2 (found in Reference 17) was used for the blockage correction.

$$U_o = U_o'(1+\epsilon) \qquad (2)$$

and

$$\epsilon = \frac{\pi^2}{12}\left(\frac{A_c}{A_T}\right)$$

It was shown earlier[18,19] that the turbulence in the free air stream could influence the transfer process considerably. The turbulence intensity at the test section was found to be 1 to 3 percent in the experiment of Reference 19 when air was brought into the tunnel without any artificial upstream disturbances. Since the wind tunnel employed for the present study was similar in physical construction to that used previously[19], it was thought that the turbulence level in the present wind tunnel would be about 1 to 3 percent also. This assumption was shown to be correct as the Nusselt numbers obtained from the present experiment checked closely with those found previously[19] for turbulence intensities less than 3 percent. (See Fig. 7).

Heat Transfer to Test Cylinder No. 1: A one-half horsepower condensing unit installed in the test room was used to refrigerate the test cylinders. R-12 was used as the refrigerant throughout the entire experiment. The R-12 flow circuit shown in Fig. 8 was used in connection with the volume measuring glass-tube shown

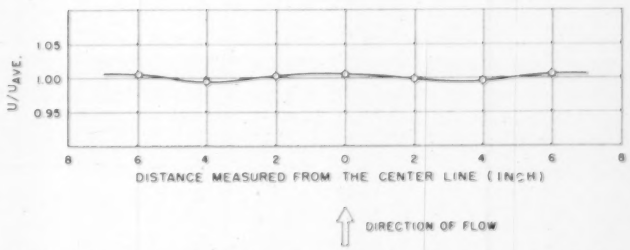


Fig. 6 — Typical velocity distribution in the test section of the wind tunnel (for average air velocity of 15.27 ft per sec)

as Fig. 9, to obtain the heat transfer measurement. As the R-12 vapor entered the glass tube from the top, the overflow type cup connected to the glass tube by a plastic tube was lowered manually. The length of the water column displaced in the glass tube by the R-12 vapor was read to 1 mm by the attached scale.

In a continuous operation the automatic expansion valve (Fig. 8) kept the evaporating temperature of the refrigerant at a constant value both in the test section and the guard section. The refrigerant entered the guard section at G and left at G' while it entered the test section at A and left at C.

As the time for the heat transfer measurement neared, the refrigerant supply to the test section was stopped by closing the needle valve A. The needle valve C was also closed and the one at B' was opened. The backpressure valve was previously set to keep the pressure upstream at the same value as the operating pressure in the test cylinder. The evaporating refrigerant vapor from the test section of the cylinder came through the back-pressure valve and was led out of the test room through a two-way valve opened to the outside. During this operation, which usually took less than a minute, the evaporating temperature in the test section was undisturbed since at no time was the pressure in the section varied. Measurement of the evaporation rate in the test section began with the opening of the two-way valve to the measuring glass tube and, at the same time, starting of a timer. Sufficient volume of the refrigerant vapor usually collected in 30 to 90 sec. At the end of the measurement the two-way valve was opened to the outside and the timer was stopped. The previous steps with the needle valves were reversed to return the test section to the original circuit.

All connections to the test cylinder were polyethylene flexible tubes. This allowed the free rotation of the cylinder necessary to obtain local heat transfer along the circumference of the cylinder. Because of the symmetry between the upper and lower

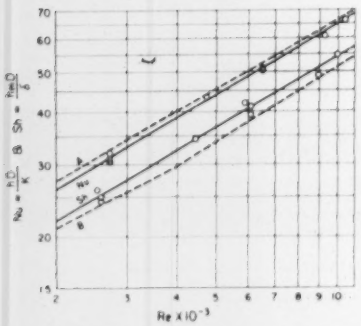


Fig. 7 — Nusselt (Nu) and Sherwood (Sh) numbers obtained for bare cylinder ($\tau = 0$)

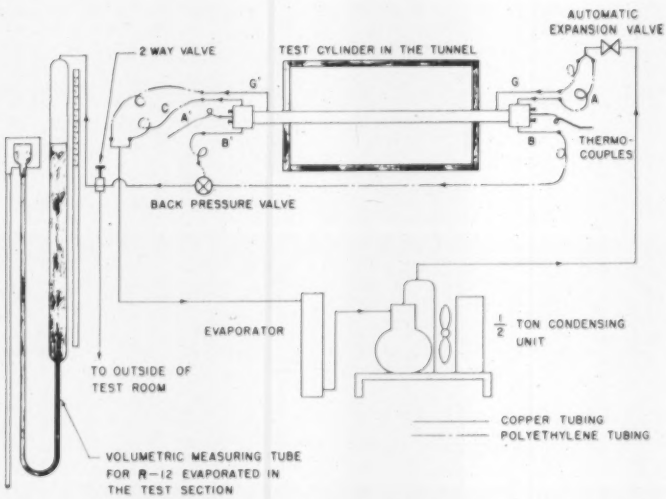
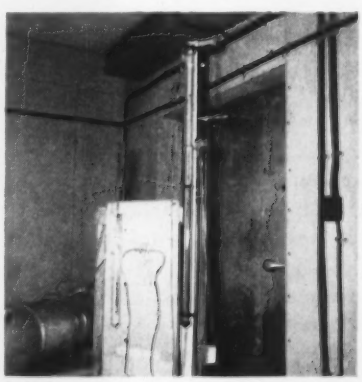


Fig. 8 — Heat transfer test set-up

Fig. 9 — Photo showing measuring glass-tube in position in test room



Nomenclature

- X = distance measured in the direction of air flow.
- U_s = velocity outside the boundary layer in the direction of air flow.
- U_∞ = free stream velocity after blockage correction.
- U'_∞ = free stream velocity before blockage correction.
- t = temperature, in general, or at the frost-air interface.
- w = specific humidity, in general or at the frost-air interface.
- t_∞ = free stream temperature.
- W_∞ = free stream specific humidity.
- Z_1 = momentum thickness of the boundary layer.
- l^* = displacement thickness of the boundary layer.
- A_f = frontal area of the test cylinder.
- A_T = free cross-sectional area of the wind tunnel at the test section.
- V_2 = volume of water displaced per unit time in the measuring glass tube.
- v_2 = specific volume of R-12 vapor in the measuring glass tube.
- v_{1f} = specific volume of saturated liquid in the test section.
- v_1 = specific volume of saturated vapor in the test section.
- L = latent heat of sublimation of the frost.
- L_s = latent heat of R-12 at the test section.
- Re = Reynolds number.
- Pr = Prandtl number.
- Sc = Schmidt number.
- Nu = Nusselt number.
- Sh = Sherwood number = $h_m D_\infty/\delta$.
- St_m = Stanton number for mass transfer = $Sh/ScRe$.
- St = Stanton number for heat transfer = $Nu/PrRe$.
- D_∞ = diameter of the bare cylinder.
- μ/ρ = kinematic viscosity.
- ρ = density.
- δ = mass diffusivity.
- C_p = specific heat at constant pressure.
- τ = time.
- θ = Defined in Fig. 10.
- h = heat transfer coefficient.
- h_m = mass transfer coefficient.
- v = vapor.
- a = air.
- w = at the solid surface.

halves of the cylinder, the heat transfer was measured only along the surface of the lower half.

Heat transfer to the test section was evaluated from the volumetric

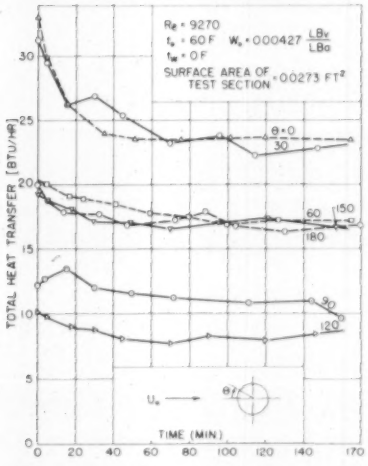


Fig. 10 — Total heat transfer measured along circumference of Cylinder No. 1

measurement of the evaporating refrigerant by Equation 3; thus

$$\text{Heat Transfer} = \frac{\frac{V_2}{V_2}}{1-\frac{V_{1s}}{V_1}} L_v \qquad \text{(3)}$$

The test cylinder was also calibrated for heat leakage between the test and guard sections.

Mass Transfer to Test Cylinder No. 2: A rectangular tray (10.064- × 1.75-in.) was constructed for measuring frost collected on the cylinder. The tray was made of 0.01 in. thick berylium copper. Both ends of the tray were cut out in a semi-circle so that the ends would fit the cylinder exactly. A lid was made in a similar manner to fit over the tray. After a predetermined period for a run, the test was stopped and the tray and the lid were pushed tightly against the cylinder until the sharp semi-circular ends cut into the frost and made contact with the cylinder surface. The portion of the cylinder surface which represented the test section was the area 10.064 in. in length which was covered by the tray and lid. After the frost was melted by raising the cylinder temperature the tray was removed, and the water film still on the cylinder surface was absorbed thoroughly and quickly by chemical filter papers and placed in the tray. The tray containing the water and filter papers was then weighed on a commercial balance and measured to 0.001 grams accurately. The net weight of the frost was obtained, finally from the gross weight.

Accuracy of the Measurements: All temperatures were measured with soldered thermocouples of 24-gage

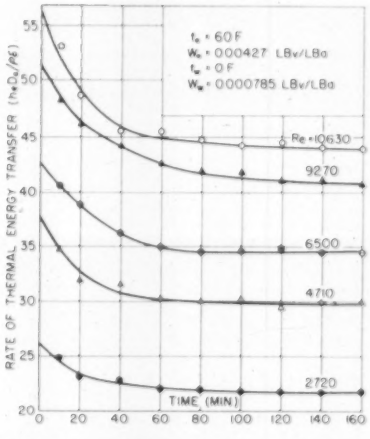


Fig. 11 — Variation of total heat transfer rate with time

copper and constantan wires previously calibrated to 0.1 F deg accuracy for the temperature range encountered. A precision portable potentiometer was used for temperature readings. With the instruments used, all temperatures obtained were estimated to be within the accuracy of 0.1 F deg.

Maximum fluctuations allowed through each test, which usually lasted 3 hours, were as follows: temperatures at test cylinder No. 1, ±0.2 F deg; temperatures at test cylinder No. 2, ±0.1 F deg; free air stream temperatures, ±1 F deg; room humidity, ±2 percent.

Test Series: The heat transfer and mass transfer experiments were conducted for the following conditions.

Series 1: Air stream temperature = 60 F; air stream specific humidity = 0.00427 lbv/lba; test cylinder surface temperature = 0 F; Reynolds numbers for heat transfer = 2720, 4710, 6500, 9270, and 10630; Reynolds numbers for mass transfer = 2592, 4430, 6020, 8920, and 9965; sensible heat ratio = 0.775.

Series 2: Air stream temperature = 70 F; air stream specific humidity = 0.0040 lbv/lba; test cylinder surface temperature = −10 F; Reynolds numbers for heat transfer = 2,720 and 6,500; Reynolds numbers for mass transfer = 2,592 and 6,070; sensible heat ratio = 0.817.

Series 3: Air stream temperature = 70 F; air stream specific humidity = 0.0084 lbv/lba; test cylinder surface temperature = 10 F; Reynolds numbers—same as series 2; sensible heat ratio = 0.625.

Formulation of the Data

Heat Transfer: A typical set of test data and corresponding calculated heat transfer values are shown in Table 1. Heat transfer values are also plotted in Fig. 10. Values shown in both the table and graph do not include correction for radiation heat transfer. To obtain the heat transfer for the bare cylinder, the first 3 test

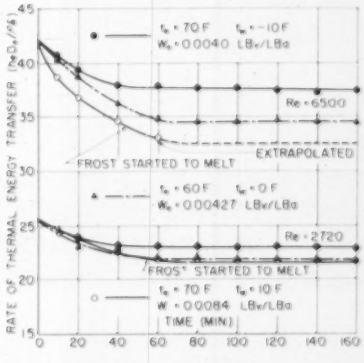

t_a = 70 F t_w = −10 F
W_a = 0.0040 LBv/LBa
Re = 6500
EXTRAPOLATED
FROST STARTED TO MELT
t_a = 60 F t_w = 0 F
W_a = 0.00427 LBv/LBa
Re = 2720
FROST STARTED TO MELT
t_a = 70 F t_w = 10 F
W = 0.0084 LBv/LBa
RATE OF THERMAL ENERGY TRANSFER (h•D₀/k)
TIME (MIN)

Fig. 12 — Variation of total heat transfer with time with Reynolds (Re) number = 2720 and 6500

points were used and the values for zero time were extrapolated. The average heat transfer for the entire cylinder is of greater interest here than the local values along the circumference. The heat transfer for the entire cylinder was obtained by summing up the 7 local values for any given

time with proper regard to test areas. The average heat transfer values for the cylinder were then corrected for radiation. In the radiation correction, it is necessary to know the air-frost interface temperature. The total heat transfer for a given air velocity was momentarily assumed to be a function only of the temperature difference between the air stream and the interface at any time. The hypothetical interface temperatures were then deduced from the total heat transfer measured at different times and the radiation corrections made. The possible error in the heat transfer values obtained due to the lack of accuracy in the radiation correction was estimated to be about 1 to 3 percent of the total heat transfer.

If the sensible heat associated with the vapor is neglected, the total heat transfer, Q_T, is:

$$Q_T = (Sh)\rho\pi\delta\left[\left(\frac{Nu}{Sh}\right)\left(\frac{Sc}{Pr}\right)(t_o - t)Cp + L(w_o - w)\right]$$

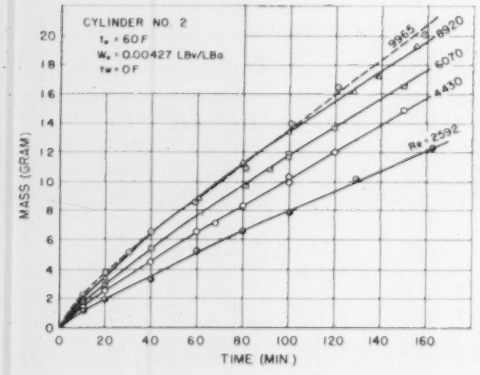


Fig. 13 — Total mass transfer Cylinder No. 2, (60 F, W_o 0.00427, t_w = 0F)

Table 1 — Typical heat transfer data

Re = 9270; θ = 30°; Barometric pressure = 14.25 psia; Average W_o = 0.0043 lbv/lba

Time min	Measuring glass tube reading cm per min	Temperature, Fahrenheit: in test section	in guard section	in free air stream	vapor in glass cyl	Heat leakage correction, Btu/min	Spec. vol. R-12 gas collected cu ft per lb	Latent heat of vaporization in test section, Btu/lb	Total heat measured, Btu per min	Net heat transfer, Btu per hr
5.0	70.4	0.45	0.85	59.0	60.1	−0.0272	3.17	68.71	0.494	29.5
15.0	61.4	−0.10	−0.17	59.0	60.2	0.0048	3.17	68.77	0.451	26.2
30.5	60.6	0.08	−0.25	59.9	60.8	0.0224	3.17	68.77	0.426	26.9
45.5	54.8	−0.25	−0.40	60.0	61.2	0.0088	3.18	68.79	0.413	25.3
69.1	54.9	−0.13	−0.28	59.9	61.0	0.0010	3.18	68.77	0.385	23.2
95.5	55.3	−0.20	−0.50	60.3	61.0	0.0204	3.18	68.78	0.374	23.7
109.0	51.2	−0.24	−0.40	60.1	61.0	0.0109	3.18	68.78	0.359	22.2
146.0	53.3	−0.25	−0.31	60.6	61.5	0.0041	3.18	68.78	0.374	22.7

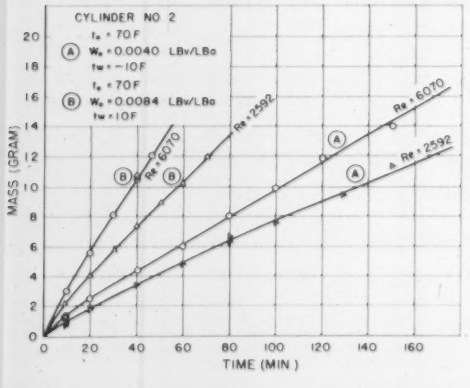


Fig. 14 — Total mass transfer with Cylinder No. 2 (test conditions as listed)

For the range of present study:

$$(Nu/Sh)(Sc/Pr) = 1.136 \ldots \text{(See Fig. 7)}$$

A total heat transfer coefficient h_e in Btu per (hour) (square foot) (Btu per pound) was defined so that:

$$(Q_t/\pi D_o = h_e\,(e_o - e_w)$$

where

$$e = 1.136\,C_{pt} + LW$$

The total heat transfer number is then defined as $h_e D_o/\rho\delta$ and for a bare cylinder this is equal to Sherwood number.

A typical tabulation of the number is shown in Table 2. Graphical representations are given in Figs. 11 and 12 for the entire series of tests. In addition, the total heat transfer at zero time was divided into sensible and latent heat transfer and the Nusselt number was calculated from the sensible heat transfer and shown in Fig. 7. The Sherwood number in the figure was obtained directly from the mass transfer test. All the property values used in the analysis were obtained from References 20 and 21.

Mass Transfer: Figs. 13 and 14 show the mass transfer as a function of time. The slopes for each curve at different times represent the instantaneous mass transfer rates.

Discussion of the Results

In Fig. 7, the Nusselt numbers obtained for the bare cylinder of the present study agree closely with those given[19] for turbulence intensity of less than 3 percent. This was predicted at the beginning from the fact that the wind tunnel set-up used was similar to that employed in the reference.

The ratio of the Stanton numbers St_m/St is equal to $(Pr/Sc)^{2/3}$ according to Colburn's analogy between heat and mass transfer. Then for the range

of the present experiments, $St_m/St = (Pr/Sc)^{2/3} = 1.036$. The actual ratio of the Stanton numbers, however, is obtained from Fig. 7 to be 0.88. It was found in earlier work[11] that the Stanton number ratio was 0.90 when a heat transfer and sublimation experiment was conducted on a frosted flat plate with the properties of air similar to those used here. Therefore the ratio obtained here agrees with that obtained in the reference.

As a test was started a uniform layer of frost usually soon formed along the entire surface of the cylinder. Fastest growth of the frost was usually observed near the stagnation point. In about 100 min the thickness of the layer was more or less evened out for the whole cylinder except near the sides of the cylinder (see Fig. 15). A definite discontinuity in the thickness and density of the frost was observed near this point. The mass transfer coefficient is minimal

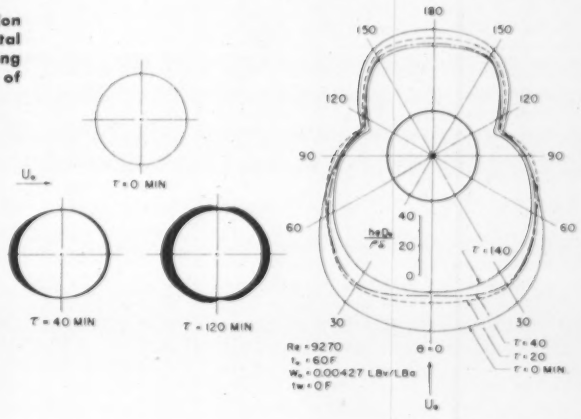
Table 2 — Typical total heat transfer number

Re = 9270; W_a = 0.00427 lbv/lba; t_a = 60 F; t_w = O F

Time, min	Heat transfer, Btu per hr			$\frac{h_m D_a}{\rho \delta}$
	Total to cyl. Q'_T	By radiation, Q_R	Total corrected, Q_t	
0	219.0	14.3	204.7	51.3
10	206.0	13.4	192.6	48.2
20	197.5	13.0	184.5	46.2
40	189.2	12.4	176.8	44.2
60	181.5	11.8	169.7	42.5
80	179.0	11.7	167.3	41.8
100	178.2	11.6	166.6	41.7
120	175.2	11.4	163.8	41.0
140	176.0	11.5	164.5	41.1
160	174.0	11.4	162.6	40.7

at this region for a cylinder. However, it was thought through the observations that the low transfer coefficient was not the only reason for the definite break in the frost formation at this region. Usually the frost was formed in a dendritic manner in this region, probably because the pressure is the lowest and the air speed high. It was thought that some of the loose dendritic frost formed at this region was continuously blown off the surface as the frost layer thickened. In all the tests conducted the frost layer thickness more or less reached a static value of 0.1 to 0.15 in. in about 2 hr all along the cylinder surface except at the sides.

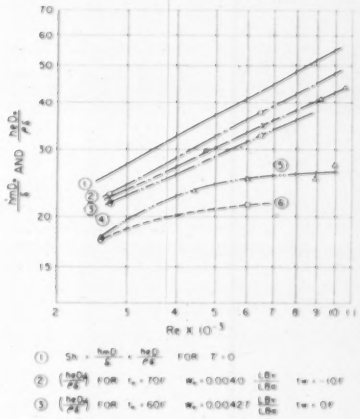
Fig. 15 — Formation of frost and total heat transfer along the circumference of the cylinder



A typical heat transfer variation with respect to time is shown in Figs. 10 and 15.

Even though the local heat transfer values varied with time rather irregularly (Fig. 10), the overall values for the complete cylinder varied quite orderly with time, (Figs. 11, 12). In all cases the heat transfer became quasi-steady in 60 to 100 min. It is interesting to remember that a similar fact was observed by Sugawara[14] in the experiment on a flat plate. As frost is formed on the surface, the density and thermal conductivity as well as the thickness of frost is continuously changed. The quasi-steady state is reached mainly as the effect of the increasing conductivity of frost nullifies the effect of increasing thickness of frost. The increased roughness of the cylinder surface with frost formation also affects the heat transfer. The 5 quasi-steady state total heat transfer numbers for test *Series* 1 were obtained from Fig. 11 and plotted in Fig. 16 as functions of the Reynolds numbers. These values line up well along a straight line with logarithmic coordinates. Line 3 in Fig. 16 represents these particular values. *Series* 2 and 3 were tested at 2 Reynolds numbers only. A straight line was drawn through the 2 test points for *Series* 2 and 3 in the light of *Series* 1.

Fig. 16 — Total heat transfer number and Sherwood (Sh) number after equilibrium is established (time > 80 min.)


70
60
50
40
30
20
15
$\frac{h_m D_a}{\rho \delta}$ AND $\frac{h D_a}{\rho \delta}$
2
3
4
5
6
7
8
9
10
11
Re X 10^{-3}
① Sh = $\frac{h_m D_a}{\delta}$ = $\frac{h D_a}{\rho \delta}$ FOR τ = 0
② ($\frac{h_m D_a}{\rho \delta}$) FOR t_a = 70F W_a = 0.0040 $\frac{LB_v}{LB_a}$ t_w = -10F
③ ($\frac{h_m D_a}{\rho \delta}$) FOR t_a = 60F W_a = 0.00427 $\frac{LB_v}{LB_a}$ t_w = 0F
④ ($\frac{h_m D_a}{\rho \delta}$) FOR t_a = 70F W_a = 0.0084 $\frac{LB_v}{LB_a}$ t_w = 10F
⑤ Sh' = $\frac{h_m D_a}{\delta}$ FOR t_a = 60F W_a = 0.00427 $\frac{LB_v}{LB_a}$ t_w = 0F
⑥ Sh' = $\frac{h_m D_a}{\delta}$ FOR t_a = 70F W_a = 0.0040 $\frac{LB_v}{LB_a}$ t_w = -10F

References

1. Heat Transfer from Humid Air to Metal Under Frosting Conditions, by E. Finch and K. Beatty (*Refrigerating Engineering*, Vol. 59, 1951, p. 1203).

2. Ice Formation on Metal Surfaces, by W. Sibbit, et al (*Refrigerating Engineering*, Vol. 62, December 1954, p. 49).

3. The Deposition of Ice Crystals on Cooling Surfaces in Low Temperature Plant, by G. Haselden (*Proceedings of Physical Society*, London, 1950, p. 157).

4. Controlling the Heat Pump, F. Ellenberger (*Refrigerating Engineering*, Vol. 57, May 1949, p. 435).

5. Analysis of Heat Transfer Over a Small Cylinder in Icing Condition on Mount Washington, by M. Tribus, et al (*ASME Transactions*, Vol. 70, November 1948, p. 971).

6. Studies on the Deposit of Frost on Cooled Surfaces, by E. Hofmann (*Die Kaealte*, Vol. 1, No. 2, 1948, p. 26).

7. How Frost Formation on Coils Affects Refrigeration Systems, by W. Stoecker (*Refrigerating Engineering*, Vol. 65, February 1957, p. 42).

8. Air: How It Is Important in Freezer Design, by V. Herman (*Refrigerating Engineering*, Vol. 64, July 1956, p. 48).

9. Der Warmuebergang an Rohren bei freier Stromung unter Beruchsichtigung der Bildung von Schwitzwasser und Reif, by W. Piening (*Gesundheits Ingenieur*, Vol. 56, October 1933, p. 493).

10. Experimental Determination of Thermal Conductivity of Low-Density Ice, by W. Coles (*NACA TN* 3143, March 1954).

11. Experimental Investigation of Sublimation of Ice at Subsonic and Supersonic Speeds and Its Relation to Heat Transfer, by W. Coles and R. Ruggeri (*NACA TN* 3104, March 1954).

12. *Engineering Developments in the Gaseous Diffusion Process*, by M. Benedict and C. Williams (McGraw-Hill Book Co., Inc., New York, 1949).

13. Einfluss des Lewisschen Koeffizienten auf das Ausfrierein von Dampfren aus Gas-Dampf-Gemischen, by H. Hausen (*Angewandte Chemie*, Vols. 19-20, 1947-48, p. 177).

14. Research on the Heat Transfer During the Period of Frost Formation, by S. Sugawara, et al (*Transactions Japanese Society of Mechanical Engineers*, 1957).

15. *Introduction to the Transfer of Heat and Mass*, by E. Eckert (McGraw-Hill Book Co., Inc., New York, 1950).

16. *Boundary Layer Theory*, by H. Schlichting (McGraw-Hill Book Co., Inc., New York, 1955).

17. *Wind Tunnel Technique*, by R. Pankhurst and D. Holder (Sir Isaac Pitman & Sons, Ltd., London, 1952).

18. Preliminary Experiments on the Influence of Turbulence on Heat Transfer, by J. Kestin and P. Maeder (*NACA TR W7-18*, July 1955).

19. Air Turbulence and Transfer Processes; flow normal to cylinders, by E. Comings, et al (*Industrial and Engineering Chemistry*, Vol. 40, 1948, p. 1076).

20. *Table of Thermal Properties of Gases* (National Bureau of Standards, Circular 564, November 1955).

21. *Heat Transfer*, Vol. 1, by M. Jakob, (John Wiley & Sons, Inc., New York, 1949).

EJC IS INCORPORATED

Acceptance of the Articles of Incorporation, granted *Engineers Joint Council* by the Secretary of State, New York, on March 20, 1958, has been voted by the majority of the member societies. On July 10 the incorporation was formalized at a special meeting of the Board of Directors and *EJC* became a membership corporation. Corporate officers elected included: President — E. R. Needles; Vice President — O. B. J. Fraser; Treasurer — E. L. Chandler; Secretary — E. P. Lange; Assistant Secretary — L. K. Wheelock.

Commenting upon the change of *Engineers Joint Council* from a voluntary unincorporated association to its corporate status, President Needles said: The incorporation strengthens the activities of *EJC* by presenting a more solid and formal organization than hitherto. It is a definite step toward unity in the engineering profession and the actions of *EJC* as a 'legal person' will carry the added weight of a homogeneous group.

At the July 10 meeting, the Board of Directors confirmed the election of the *American Institute of Plant Engineers* as an associate member, effective July 10th. This brings the number of societies in *EJC* to nineteen.

Representatives of ASHAE to the *Engineers Joint Council* are: P. B. Gordon, New York, N. Y.; A. J. Hess, Los Angeles, Calif. (alternate); and Pres. E. R. Queer, University Park, Pa. (ex-officio).

ARI BOOKLET ON AIR CONDITIONING AND REFRIGERATION

The *Air Conditioning and Refrigeration Institute* has published a 32-page booklet containing an outline of the present situation concerning the use of air conditioning and refrigeration. Space is devoted to *Air Conditioning in Industry*, to *Air Conditioning and Business*, *Air Conditioning and Health*, *Air Conditioning at Home*, and *Air Conditioning and Defense*.

The refrigeration section is devoted to such topics as *Refrigeration and the Nation's Food Supply*, *Refrigeration in the Nation's Industry*, *Refrigeration and the Nation's Health*, and *Refrigeration and Defense*.

The booklet also contains an outline of the nature of the air-conditioning and refrigeration industry. Excellent use is made of illustrations throughout. The entire undertaking is prepared in popular style and is aimed at non-professional readers.

SMALL HOUSE INVESTIGATION

How to carry on the battle with the elements receives substantial attention in a recent book *The Investigation of the Small House* which resulted from a study of many phases of home building in The School of Architecture, Pratt Institute.

Among the chapters included in the book are ones having to do with control of the elements, roof designs for heating and cooling, foundation considerations having to do with heating and cooling, the control of moisture and the use of insulation, air conditioning and heating equipment.

This book is prepared for general reading and, while it contains a considerable amount of technical information, it is not a book prepared for technologists. It does, however, contain some statements which will be of interest to many engineers. The book is obtainable from The School of Architecture, Pratt Institute, Brooklyn 5, N. Y. at $2.00 a copy.

ENGINEER TECHNICIANS

An interesting trend in recent years has been the increasing use of technicians to work with engineers and physical scientists. Recently, a report on this subject has been published as *VA Pamphlet* 22-1, which was prepared by Dr. Bernard Michael and is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at 25 cents per copy. The pamphlet tells of the nature of the work done by technicians and gives some data concerning their current earnings.

COMFORT STUDIES STARTED

E. F. Snyder, Jr., Chairman, Committee on Research, has announced that environmental testing with subjects started in the new environmental test facility at the Laboratory during July. Work is actively being carried out on the first phase of the investigation, namely, a re-evaluation of comfort responses in certain regions of the comfort chart. This aspect is only one of a number of long-term projects which have been planned for the room.

JOINT COMMITTEE ON EQUIPMENT SOUND TESTING MEETS

A meeting was held in Minneapolis on June 22 of the members of the Joint Committee on Equipment Sound Testing of ASHAE and *ASRE*. During the course of the meeting, the writing of a standard for Reverberant-Room and Substitution Methods was assigned to C. M. Ashley, Syracuse, N. Y., and R. J. Wells, Schenectady, N. Y. It is expected that the actual writing of this standard will be undertaken in the immediate future. Mr. Ashley was also given the assignment of looking into the possibility of obtaining a Standard Sound Source and it was recommended that the ASHAE Laboratory obtain one of these sound sources for testing purposes.

An assignment was also given to R. D. Madison, Buffalo, N. Y., and W. F. Kerka, Cleveland, Ohio, of the ASHAE Research Laboratory staff, for writing a standard covering the Induct Test Method.

JUNE COUNCIL MEETING

The regular Semi-Annual Meeting of the Council was held on June 22 at the Pick-Nicollet Hotel in Minneapolis. President Queer presided and all members of the Council were present. Important actions taken included authorization for lease of Headquarters space, budget adjustments and adoption of a set of resolutions stating the publication policy of the Society.

With the proposed merger between ASHAE and *ASRE* occupying so prominent a position, the Council took a number of actions having to do with the report of the Joint ASHAE-*ASRE* Committee on Cooperation. Also a large part of the time of the meeting was occupied with a careful consideration and discussion of the details of the plan for merger.

The Council went on record as recommending to the Committee on Co-operation that the Board of Directors of a merged organization should be smaller than 24 in number. The Council also recommended to the Committee that the name of a merged society might be AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS.

The Council approved in principle the plan for merger with *ASRE* as set forth in the memorandum of the Committee on Cooperation dated June 22, 1958. Council also authorized preparation of the necessary documents needed in connection with the merger plan and took steps to empower action on the contract covering the publication of the JOURNAL.

As an innovation in the operation of local chapters, Council passed a resolution permitting the organization of women's auxiliaries at local chapter level when such auxiliaries can be organized and operated under suitable conditions. Council also took note of steps being taken in connection with the formation of 2 additional local chapters. Numerous actions were taken in connection with membership activities.

Resolutions were passed authorizing various cooperative contracts for carrying out specific projects recommended by the Committee on Research. These included arrangements with Case Institute of Technology, University of Illinois, Pennsylvania State University, University of Pittsburgh and Kansas State College. Authorization was also given for negotiations looking toward continuation of studies being conducted for the U. S. Navy. Additional work was also approved in modifying the Human Calorimeter, built some years ago for use at Bethesda, Md.

MEETINGS OF TECHNICAL ADVISORY COMMITTEES AT MINNEAPOLIS

The program for the Semi-Annual Meeting at Minneapolis included meetings of 9 technical advisory committees. These meetings, which are generally open, attract numerous visitors in addition to the members of the committee. All of them center around the activities and interests of the committee, but frequently the discussions which take place are of such value that visitors attend.

TAC on Air Cleaning

Copies of a progress report covering work being done at the University of Minnesota were distributed. The report had been prepared to permit the committee to make decisions concerning the project. Preliminary loading tests had been started and it was hoped to determine the effect of the size of lint on the filter performance. Technical discussions revolved around procedural points in connection with the testing.

It was also suggested that the organization of the committee might be changed to allow the work to be assigned to small groups. It was agreed that the committee would analyze the progress report with comments being made to the chairman who would arrange to have them reproduced for the information of the committee members.

The matter of increasing the membership on the committee was considered and it was suggested that an augmented membership would be helpful. The committee voted to suggest to the chairman of the Committee on Research that as many as 3 additional persons should be added to the committee from the air filter industry.

The chairman also asked that each member offer comments and suggestions concerning the research program and members responded with various suggestions including rate of dust loading and the effect of various proportions of dust and lint.

TAC on Combustion

A report was presented covering the closing phases of the work sponsored by the Committee at Battelle Memorial Institute. It was indicated that 4 papers were to be prepared on various phases of the project.

It was also indicated that it is not expected that the present work at Battelle will be continued since the project, as originally outlined and undertaken, is substantially completed.

The Committee gave attention to a list of suggested research projects related to combustion. As a result, it was voted that the Committee recommend the activation of a research project on the Analysis of the Mechanism of Deposit Formation in Fuel Nozzles as affected by Fuel Characteristics, Nozzle Materials, and Nozzle and Fuel Temperatures.

It was also suggested that the Society sponsor an invitation meeting to survey research needs in the field of combustion. Since this seemed like a desirable undertaking, the Committee voted that it be recommended to the Committee on Research.

TAC on Hot Water and Steam Heating

Important among the actions taken by this committee were ones having to do with steam-flow information which appears in the current issue of THE GUIDE. It has been proposed that revisions be made and the committee recommended use of a basic steam-flow chart together with supplementary steam-flow charts. It was recommended that this revised information on the flow of steam appear in an early issue of THE GUIDE.

The committee also voted to endorse the action of the Committee on Research in continuing the project on Noise in Pipe Systems at Northwestern University, and on Venting of Hot Water Systems at the University of Illinois.

The committee also gave attention to the subject of Pickup Factors for Boilers, to Flow in Fin-Tube Radiation and to High-Temperature Hot Water.

A sub-committee consisting of J. R. Carroll, Urbana, Ill., R. B. Luhnow, Jr., Kansas City, Mo., John W. James, Chicago, Ill., and G. F. Carlson, Morton Grove, Ill., was appointed to study the scope of the high-temperature water problems.

TAC on Insulation

The work of this Committee is carried on by task groups, to which committee members are assigned. At the present time, there are 10 such groups, each charged with important phases of the committee activities. Considerable part of the meeting was occupied with the reports of these various task groups and the discussions which they brought forth.

The task group charged with study of Moisture in Insulated Built-Up-Roofs and Effect of Moisture on Thermal Conductivity proposed definitions of permeability, permeance and perm and the committee approved the use of the suggested definitions in the forthcoming issue of THE GUIDE.

The chairman of the committee reported that information on attic ventilation for use in the forthcoming issue has been prepared and approved. The chairman also reported that the group having to do with Loose-Fill Insulation Settlement was working with an *ASTM* subcommittee on a draft of a proposed test code.

The task group charged with keeping the Guide material on insulation under continuing revision reported on a considerable number of suggested changes in the existing Guide material. Many of these were changes suggested in the wording for clarification. The whole committee acted to accept the findings of this group and recommended that the Guide material be revised accordingly.

The group which is working on Parallel and Series Heat Flow reported that a pro-

posed method for making transmittance calculations of parallel and series heat flow circuits has been written up and is in process of review by the committee.

TAC on Sorption

This committee took steps to have the Committee on Research broaden its scope in order to cover problems related to sorption of moisture. A sub-committee of 3 consisting of H. L. Barnebey, Columbus, Ohio, Chairman, G. A. Kelley, Toledo, Ohio, and R. J. Getty, E. St. Louis, Ill., was appointed to coordinate the work being done under the committee's auspices at the University of Toledo and Pennsylvania State University.

It was also decided that a committee consisting of E. W. Gifford, Milwaukee, Wis., G. A. Kelley, and G. C. F. Asker, Falls Church, Va., be authorized to proceed with revising the material on sorption now appearing in the GUIDE. There was discussion concerning a proposed testing code for sorption dehumidification equipment, and it was indicated that there continues to be a demand on the part of users for such a code.

LOCKE HEADS MICRO SWITCH

James S. Locke has been elected vice-president and general manager of the Micro Switch division of Minneapolis-Honeywell Regulator Co.

Mr. Locke has been a member of the Society for many years. He has been very active, having been President of both Illinois and Minnesota Chapters. In addition to having served on a number of Society Committees, he is at present a member of the Charter and By-Laws Committee and the Nominating Committee. Mr. Locke was also Chairman of the Committee on Arrangements which planned the Semi-Annual Meeting held in Minneapolis in June.

YELLOTT OPENS CONSULTING OFFICE

John I. Yellott, a member of the Society, has announced formation of John Yellott Associates with headquarters at 901 West El Caminito, Phoenix, Ariz. to render consulting services in the field of mechanical engineering. A registered professional engineer in Arizona, Maryland and New Jersey, Mr. Yellott will specialize in power generation by steam and gas turbines, fuel utilization, energy conversion, and particularly in applications of solar energy to special problems in space heating and cooling.

Mr. Yellott, who holds two engineering degrees from the John Hopkins University, spent the first twelve years of his career in the fields of engineering education and research. He also served as a consultant on atomic power generation for the Metallurgical Laboratory of the University of Chicago. During the following ten years he was Director of Research for the coal-burning gas turbine program of Bituminous Coal Research. During 1956 and 1957 he was an Assistant Director of Stanford Research Institute and Executive Director, *Association for Applied Solar Energy*, Phoenix, Ariz. Mr. Yellott is President-Elect of the *Arizona Academy of Science*.

KOCH JOINS LABORATORY STAFF

The Laboratory has been fortunate in obtaining the services of Dr. Walter Koch to guide the medical-physiological aspects of its research. Dr. Koch joined the Laboratory staff on July 1. Prior to coming to the United States, Dr. Koch was lecturer at the Hebrew University at Jerusalem and has served on the staff of that Institution as teacher and researcher since 1940. Dr. Koch has carried out a prodigious amount of research in the field of environmental physiology and medicine and has published more than seventy-two papers.

Dr. Koch is Austrian-born and received an M.D. degree from the University of Vienna in 1933. This was followed by the degree of Ph. D. in 1936. He interned at the hospital at the City of Vienna and was section head, Department of Medicine, at the Vienna Poliklinik. In addition to his studies in environment, he worked under

Dr. Walter Koch

research grants to study the action of vitamins and served as a physician in Austria and Israel. Dr. Koch has also been active in the development of instrumentation for the general field of environment and human physiology. He is a member of many organizations including the *Royal Society for the Protection of Health* (London).

CANDIDATES FOR MEMBERSHIP

Listed here are the names of 119 men who are the candidates for membership or advancement in membership grade. Members are requsted to assume their full share of responsibility of receiving these candidates into membership by advising the Executive Secretary before September 30, 1958 of any whose eligibility for membership is questioned. Unless such objection is made these candidates will be voted upon by the Council.

Note: **Advancement* †*Reinstatement*

California (*Region* 4)

AINSWORTH, K. H.†, Mech. Engr., Leonard S. Stecher, Sacramento.

LIPSHULTZ, MAX, Mech. Engr., J. S. Hamel Engineering, Burbank.

PATEL, K. R., Mech. Engr., Los Angeles.

SLATER, F. H., Asst. to Gen. Sales Mgr., Air Filter Sales and Service Co., San Francisco.

TREECE, W. W., Cons. Engr., Santochi & Brienen, Los Angeles.

Colorado (*Region* 3)

BAUER, HERMAN, Mech. Engr., Skidmore, Owings & Merrill, Colorado Springs.

Georgia (*Region* 5)

DEAN, B. W.*, Engr., Robert and Company Associates, Atlanta.

Illinois (*Region* 2)

LACOSSE, R. A., Tech. Dir., *Insulation Board Institute*, Chicago.

Maryland (*Region* 5)

ACREE, G. E., Vice Pres., Standard Insulation Products, Inc., Baltimore.

BARNES, N. D., Secy-Treas., M. Nelson Barnes & Sons, Inc., Baltimore.

BOCEK, T. P., Estimator, Hajoca Corp., Baltimore.

BRAVERMAN, S. I., Chief Engr., Industrial Dept., The Poole & Kent Co., Baltimore.

BRIDGES, J. R., Mech. Estimator, Riggs Distler & Co., Inc., Baltimore.

BROOKS, R. K., Estimator, Riggs Distler & Co., Inc., Baltimore.

CATALINA, P. F., JR., Sales Engr., Dunham-Bush, Inc., Baltimore.

CAVEY, E. K., Mech. Estimator, Riggs Distler & Co., Inc., Baltimore.

CONNOLLY, R. P., Sales Repr., Owens Corning Fiberglas Corp., Baltimore.

CRESWELL, C. J., Mech. Engr., Green Associates, Inc., Baltimore.

CROCKER, J. R., Pres., The John R. Crocker Co., Baltimore.

CROKER, D. V., JR., Secy-Treas., Croker & Stallings, Inc., Baltimore.

CROCKETT, A. H., JR., Br. Sales Mgr., Carrier Corp., Baltimore.

EASTER, J. H., Pres., Easter & Woodward, Inc., Baltimore.

EINBECK, F. A., Sales Engr., Carrier Div., United Clay & Supply Corp., Baltimore.

EVERHART, W. C., Mech. Engr., Martin Co., Baltimore.

FARRELL, J. H., Sales Engr., Wm. E. Kingswell, Inc., Baltimore.

FORSTER, H. E., Pres., Forster Transfer & Rigging Co., Inc., Baltimore.

FREEMIRE, E. L., Pres., Freemire & Assoc., Inc., Baltimore.

GARNER, T. A., Mgr., Htg. & Plbg. Sales., Frederick Trading Co., Frederick.

GORMAN, T. A. 3rd., Proj. Mgr., Lloyd E. Mitchell, Inc., Baltimore.

GRADY, E. G. JR., Treas., Bems Sheet Metal Fabricators, Inc., Baltimore.

GRANGER, H. E., Archt. & Engr. Contact Man, Crane Co., Baltimore.

GREEN, D. A., Pres., Consolidated Equipt., Inc., Baltimore.

GREGORY, C. Z., SR., Asst. Store Mgr., Hochschild Kohn, Baltimore.

GRILL, L. F., Sales Engr., Mexico Refractories Co., Baltimore.

GUIDERA, J. W., Vice Pres., McArdle & Walsh, Inc., Towson.

HESSLER, O. J., Mech. Engr., Eiser & Akers, Baltimore.

HORTON, B. H., Rigging Estimator & Traffic Engr., Forster Transfer & Rigging Co., Baltimore.

JACKSON, E. R., Owner, Rolanson Cleaning Service & Air Filter Co., Baltimore.

JOBE, H. M., Owner, Jobe & Company, Baltimore.

JONES, J. P., Supvsr. Com. Gas Sales, Baltimore Gas & Electric Co., Baltimore.

KELLY, M. J., Pres., Kelco Corp., Baltimore.

KESSLER, S. W., Chemical Engr., U. S. Army Chemical Corps., Engrg. Command, Baltimore.

KIRKWOOD, B. J., Estimator, M. Nelson Barnes & Sons, Inc., Baltimore.

KNESS, R. J., Proj. Engr., James K. Wolford, Baltimore.

KOHR, T. J., JR., Estimator, W. Earl Hershey, Inc., Baltimore.

LACH, J. L., Sales Repr., Johns Manville Sales Corp., Industrial Insulation Div., Baltimore.

LANE, R. M., Repr., Freemire & Assoc., Inc., Baltimore.

LAVALLY, C. J., Sales Engr., American Blower, Division of American Standard, Baltimore.

LONG, R. F., Br. Mgr., Ilg Electric Ventilating Co., Baltimore.

MAY, C. L., Partner, Lancaster May & Co., Baltimore.

MCKINLAY, DONALD, Sales Engr., H. P. Rodgers, Mfrs. Repr., Baltimore.

MITCHELL, C. E., Pres., J. E. Perkins Corp., Baltimore.

PITT, C. G., Pres., The Bibb Heating & Equipment Co., Baltimore.

PUMPHREY, EDGAR, Pres., Wesley Freeman, Inc., Baltimore.

RANDALL, C. H., Supt., L. E. Mitchell, Baltimore.

RHODES, E. A., Repr., Fisher Governor Co., Baltimore.

RICE, B. MCC., Comptroller, Br. of Director, The Paul-Rice Engineering Co., Inc., Baltimore.

RICE, C. E., SR., Pres., The Paul-Rice Engineering Co., Inc., Baltimore.

RIPPEL, R. R., Proj. Mgr., Riggs Distler & Co., Inc., Baltimore.

ROSKES, D. S., Supt. of Public Bldgs., City of Baltimore, Baltimore.

ROSS, W. C., Mech. Engr., Linthicum.

ROYCROFT, F. F., JR., Draftsman, The Poole & Kent Co., Baltimore.

RUBENKONIG, FRED, Sales Engr., National-U.S. Radiator Corp., Baltimore.

RUTH, C. W., Pres., Ruth Engineering Co., Inc., Baltimore.

SAVAGE, D. T., Com. Salesman, Minneapolis-Honeywell Regulator Co., Baltimore.

SAWYER, C. W., Vice-Pres., Wesley Freeman, Inc., Baltimore.

SCHAEFER, C. W., Pres., General Automatic Products Corp., Baltimore.

SCHLEGEL, G. A., Chief Engr., The Globe Brewing Co., Baltimore.

SCHOFIELD, J. B., Proj. Engr., Anderson-Nichols & Co., Baltimore.

SCHUMAN, G. H., Pres., The Geo. H. Schuman Co., Inc., Baltimore.

SEWARD, J. W., SR., Supvsr. of Engrs. (Dept. Head), Bethlehem Steel Co., Baltimore Yard, Marine Div., Baltimore.

SHEPARD, H. B., Asst. Sales Mgr., Baltimore Aircoil Co., Inc., Baltimore.

SPEDDEN, W. R., Sales Engr., Johnson Service Co., Baltimore.

STAHL, T. E., Inside Salesman, Hajoca Corp., Baltimore.

STOUDENMIRE, L. C., Mech. Engr., City of Baltimore.

STELLMANN, E. B., Vice Pres. & Treas., The Bibb Heating & Equipment Co., Baltimore.

TAYLOR, H. M., JR., Secy., Consolidated Supply Co., Inc., Baltimore.

TRIBULL, B. E., Sales Engr., R. H. Bozman Bros., Inc., Baltimore.

WACLAWSKI, L. J., Repr., General Plumbing Supply Co., Baltimore.

WAKEMAN, L. B., Pres., Bryant Gas Equipment, Inc., Baltimore.

WASSERMAN, B. S., Mech. Designer, Anderson-Nichols & Co., Baltimore.

WESTENDORF, E. R., Sales Repr., Electronics Corp. of America, Baltimore.

WILEY, K. E., Proj. Mgr., Riggs Distler & Co., Inc., Baltimore.

WRIGHT, D. E., Designer, James Posey & Associates, Baltimore.

YATES, J. H., Pres., N. H. Yates & Co., Inc., Baltimore.

Massachusetts (*Region* 1)

CROWLEY, C. A., JR., Engr., Francis Associates, Marion.

MORRILL, C. W., Sales Engr., D. M. Archer & Co., Boston.

Michigan (*Region* 2)

LAWRENCE, W. E., Mech. Engr., Stone, Smith & Farent, Kalamazoo.

Minnesota (*Region* 3)

JOHNSON, H. W., JR., Engr. Trainee, U. S. Army Corps of Engineers, St. Paul.

New Mexico (*Region* 6)

DWYER, G. W., Partner, Vice Pres., Barnhart-Dwyer Engineering Co. Inc., Albuquerque.

New York (*Region* 1)

ABRAMS, DAVID, Gen. Asst., E. J. Brandt & Co. Inc., Long Island City.

HEIN, PETER, Engr., Wolff & Munier Inc., New York.

MAHON, W. L.*, Service Mgr., Lewis Associates, Inc., Port Washington.

PARK, I. C., JR., Sales Engr., Jacobson & Co. Inc., New York.

SCHROTT, W. J., Estimator-Engr., Joseph Davis, Inc., Buffalo.

North Carolina (*Region* 5)

MCDOWELL, J. M.*, Bryan Associates, Charlotte.

Ohio (*Region* 2)

DAY, H. D., JR., Appl. Engr., Chrysler Corp., Airtemp Div., Dayton.

HARMON, W. M., Chief Engr., United Sheet Metal Co., Inc., Columbus.

HULTZ, W. S.†, Research & Dvlpt. Engr., The C. A. Olsen Manufacturing Co., Elyria.

LOUCKS, J. E., Asst. Dir., Industry Relations, ASHAE Research Laboratory, Cleveland.

MCCLANAHAN, M. A., Mech. Designer, McGraw Construction, Inc., Middletown.

Oklahoma (*Region* 6)

HENDERSON, J. R., JR., J. R. Henderson Co., Oklahoma City.

Tennessee (*Region* 5)

VALENTINE, T. L., A-C & Htg. Engr., Samuel L. Burns & Assoc., Inc., Memphis.

Texas (*Region* 6)

BARTLETT, H. W., Repr., Homer G. Maxey & Co., Lubbock.

GRANT, H. D.†, Sales Engr., H. D. Grant Co., Houston.

Washington (*Region* 4)

ALLEN, G. L., Engr. & Estimator, W. E. Beggs, Inc., Seattle.

BARROW, J. W., Repr., Norman S. Wright & Co., Seattle.

Canada (*Region* 7)

FINNAN, I. D., Constr. Engr., Delton Hardware & Tin Shop, Edmonton, Alta.

GRAY, D. H., Marine Mgr., Norris Warming (Canada) Ltd., Montreal, Que.

KNIGHT, A. J., Br. Mgr., Napanee Iron Works, Ltd., Calgary, Alta.

LECLERC, MARCEL, Repr., Honeywell Controls, Ltd., Ste. Foy, Que.

PERRY, K. J. G.*, Chief Estimator, Moncton Plumbing & Supply Co., Ltd., Moncton, N.B.

TURNER, G. V., Br. Mgr., General Controls Co. (Canadian) Ltd., Winnipeg, Man.

Australia

FAKES, I. G., Contact Engr., J. Wildridge & Sinclair Pty., Ltd., Sydney.

NIELSEN, F. W., Dir., Frederick W. Nielsen, Pty Ltd., Mootabbin.

WATSON, GEORGE, Asst. Gen. Mgr. & Director, Watson Bros. Ltd., Brisbane, Queensland.

JOURNAL SECTION

Ireland

BOLAND, F. V., Partner, Lyons, Boland & Partners, Dublin.

Scotland

MOORE, G. H., Br. Mgr., H. Cheetham & Co., Glasgow.

West Pakistan

SAUNDERS, G. F., Engr., Pakistan Ordnance Factories, Wah Cantt.

OBITUARIES

ROWLAND H. LOCK
Toronto, Ont.

Rowland H. Lock, a member of the Society since 1939, died July 15 in Toronto. Mr. Lock was president and general manager of J. H. Lock and Sons Ltd., refrigerating contractors and steel fabricators.

Active in professional organizations, Mr. Lock also belonged to the Canadian Club, Board of Trade, and Kingsway Masonic Lodge. A member of Toronto Downtown Kiwanis Club since 1942, he served as its president in 1948 and as Lieutenant-Governor of the organization's District 5 in 1949. Mr. Lock held membership in *ASRE* and *Canadian Refrigeration and Air Conditioning Association*.

He leaves his wife, a daughter and two grandchildren.

EDWARD B. SHEFFIELD
Toronto, Ont.

Edward B. Sheffield, past president of the Society's Ontario Chapter, died June 20 at his home in Toronto. Mr. Sheffield became a member of the Society in 1921. He was employed by Mathers and Haldenby of Toronto, an architectural engineering firm.

Mr. Sheffield is survived by his wife, son, daughter and four grandchildren.

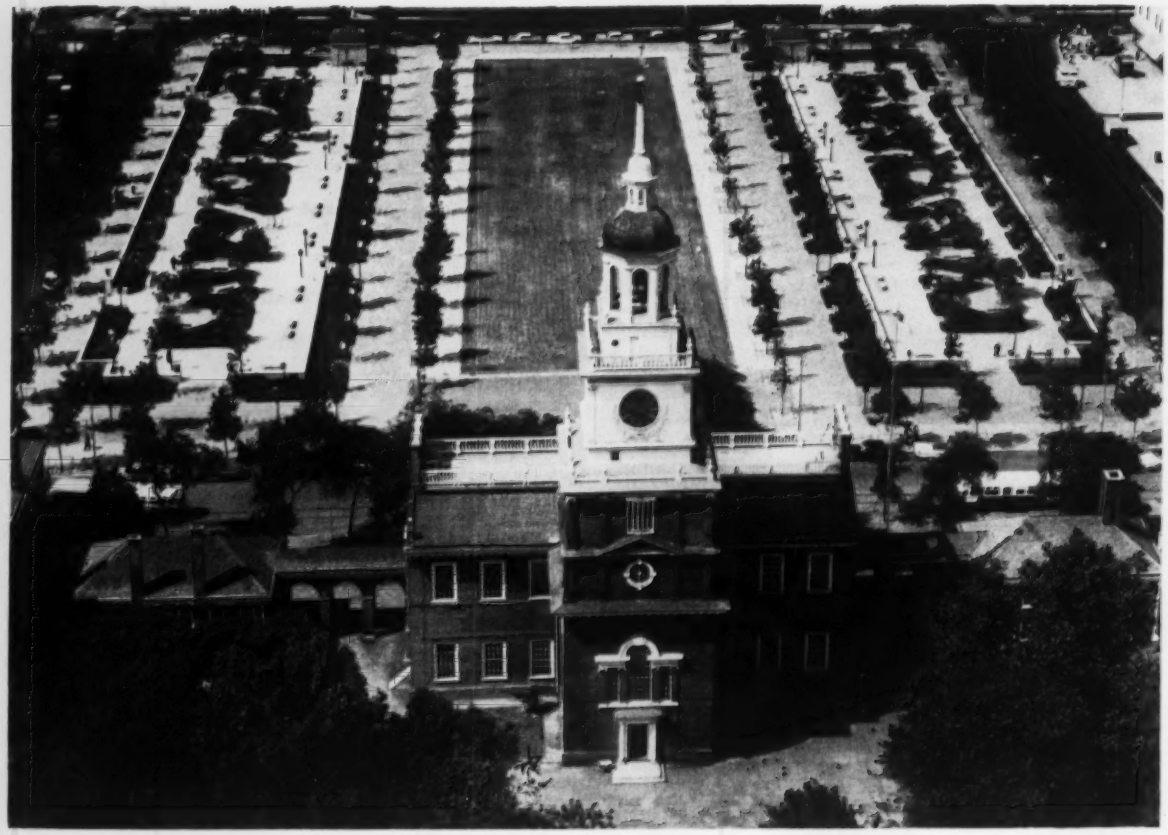
MERVYN G. WALTERS
San Fernando, Calif.

Mervyn G. Walters, a member of the Society since 1950, died June 10. Mr. Walters was chief specifications writer for the architectural firm of Daniel, Mann, Johnson, & Mendenhall, Los Angeles. Born in Ontario, Canada in 1910, he became a United States citizen.

Mr. Walters was graduated from the University of Toronto with a degree of Bachelor of Architecture. He came to this country after securing an extensive knowledge of the construction and engineering field in Canada.

Mr. Walters was also a member of the *Construction Specifications Institute*.

He is survived by his widow who resides in San Fernando, California.



Philadelphia Host In January For Annual Meeting, Exposition

The 65th Annual Meeting of the Society will be held in Philadelphia, Pa. from January 26-29, 1959 with headquarters at the Bellevue-Stratford Hotel. Simultaneously the 14th International Heating and Air-Conditioning Exposition, under the auspices of ASHAE and managed by the International Exposition Company, will take place in Philadelphia's Convention Hall. Prior to the opening of the Annual Meeting and the Exposition on Monday, January 26 the Council and various committees will meet on Saturday and Sunday, January 24 and 25, 1959.

The Annual Meeting will consist of seven Sessions including three Symposiums and one Topical Session. The Topical Session will consist of papers concerned with Human Comfort as related to indoor environment. One of the Symposiums will be on the general subject of Hydronics, another on Heat-Pump Performance and the third Symposium will be on Corrosion and Water Treatment. The various papers planned for the 65th Annual Meeting have been selected for their timely interest.

E. K. Wagner, General Chairman of the Philadelphia Chapter Committee on Arrangements, has announced that several preliminary meetings of this commitee have been held. The following members of the Philadelphia Chapter are serving on this committee: J. J. Hucker and R. P. Schoenijahn, Honorary Chairmen; F. H. Buzzard, Vice Chairman; Banquet—J. J. Hucker, Chairman; Entertainment—H. B. Prewitt, Chairman; Exposition—C. J. Lubking, Chairman; Finance—P. H. Yeomans, Chairman; Ladies—R. F. Buzzard, Chairman and Mrs. R. F. Buzzard, Co-Chairman; Publicity—Ludwig Mack, Chairman; Reception—P. A. Cavanagh, Chairman; Sessions—A. M. Robertson, Chairman; Transportation—D. S. Plewes, Chairman.

Notable speakers for the Welcome Luncheon and the 65th Annual Banquet will be announced shortly by the Committee on Arrangements. In addition there will be a Monday evening Get-Together Party and other special events of interest to everyone including the ladies and children.

Hotel reservation forms and an advance program were sent to all members as of July 31. It is strongly recommended that hotel reservations be made promptly so that it will be possible to secure the accommodations desired.

Headquarters Office
62 Worth St., New York 13, N.Y.
Tel: BArclay 7-6262

(For names of Society Officers see p. 154)

Research Laboratory
7218 Euclid Ave., Cleveland 3, Ohio
Tel: UTah 1-6161

Presidents and Secretaries of Society Chapters and Branches

The Society has chartered 72 Chapters, 1 Overseas Branch, and 6 Student Branches. These organizations elect their own officers and governing boards. Following is a list giving the name and address of the president and secretary of each of these groups.

Date indicates year organized; and address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

ARIZONA

Arizona: 1953. Hdqrs., Phoenix. Meets, 1st Mon. PRES, F. W. Gabbard, 111 East 14th St., Tempe. SECY, J. R. Hight, 6145 N. 31st Dr.

ARKANSAS

Arkansas: 1952. Hdqrs., Little Rock. Meets, 3rd Tues. PRES, K. A. Pettit, 904 Wallace Bldg. SECY, O. L. McCallister, 6 Belmont Dr.

CALIFORNIA

Golden Gate: 1937. Hdqrs., San Francisco. Meets, 1st Thurs. PRES, Herb Duncan, 938 N. Linden Ave., South San Francisco. SECY, T. R. Simonson, 507 Howard St. (5).

Sacramento Valley: 1952. Hdqrs., Sacramento. Meets, 1st Wed. PRES, M. J. Delavan, 405 Meister Way (19). SECY, R. T. Andrews, 4305 Laurelwood Way (21).

Southern California: 1930. Hdqrs., Los Angeles. Meets, 1st Tues. PRES, A. Z. Levine, 1127 Crenshaw Blvd. (19). SECY, Albert Zimmerman, 1919 S. Crescent Hts. Blvd., (34).

COLORADO

Rocky Mountain: 1944. Hdqrs., Denver. Meets, 1st Wed. PRES, J. R. Wilson, 3400 Estes St., Wheat Ridge. SECY, R. J. Walker, 4505 Balsam, Wheat Ridge.

CONNECTICUT

Connecticut: 1940. Hdqrs., New Haven. Meets, 3rd Thurs. PRES, R. B. Cahoon, 150 James St. (13). SECY, E. M. Johnson, 1007 Farmington Ave., W. Hartford.

DISTRICT OF COLUMBIA

Washington, D.C.: 1935. Hdqrs., Washington, D.C. Meets, 2nd Wed. PRES, H. W. Rush, 116 Southwood Ave., Silver Spring, Md. SECY, L. D. Pain, 102-B Ames Rd., Silver Spring, Md.

FLORIDA

Jacksonville: 1957. Hdqrs., Jacksonville. Meets, 1st Tues. PRES, John R. Spence, 802 Kipp Ave. (7). SECY, William D. Minick, 1013 Eighth St., N. Jacksonville Beach.

GEORGIA

Atlanta: 1937. Hdqrs., Atlanta. Meets, 2nd Mon. PRES, J. S. Edgar, 2015 Peachtree Rd., N. W. SECY, Bob W. Dean, 3075 Piedmont Rd., N. E. (5).

Savannah: 1958. Hdqrs., Savannah. PRES, E. F. Young, 2805 Aimar Ave. Bonna Bella Pt. SECY, R. L. Hume, P. O. Box 1788.

ILLINOIS

Illinois: 1906. Hdqrs., Chicago. Meets, 2nd Mon. PRES, Herbert Kreisman, 117 N. Desplaines St. (6). SECY, J. C. Scott, 6655 N. Ridge Blvd. (26).

Illinois-Iowa: 1956. Hdqrs., Moline. Meets, 3rd Mon. PRES, D. H. Ninow, 1824 Third Ave. SECY, R. F. Demange, 307 16th St.

INDIANA

Indiana: 1943. Hdqrs., Indianapolis. Meets, 4th Tues. PRES, W. F. Currise, 619 Architects & Builders Bldg. (4). SECY, A. B. Keller, 4320 Glencairn Lane (18).

IOWA

Iowa: 1940. Hdqrs., Des Moines. Meets, 2nd Tues. PRES, Richard T. Howard, Jr., 220 Davidson Bldg. SECY, John R. Bain, 1911 Ingersoll.

KANSAS

Kansas: 1951. Hdqrs., Wichita. Meets, Tues. after 1st Mon. PRES, Gene L. Oswald, 1117 E. Waterman (7). SECY, Robert B. Peugh, 307½ Laura (1).

KENTUCKY

Bluegrass: 1954. Hdqrs., Louisville. Meets, 2nd Mon. PRES, O. J. Hill, 319 W. Jefferson St., Rm. 316 (2). SECY, H. L. Carr, 2725 Shannon Dr. (5).

LOUISIANA

Baton Rouge: 1955. Hdqrs., Baton Rouge. Meets, 3rd Wed. PRES, W. J. LeBlanc, 3185 Government St. SECY, R. F. Dupuy, 5223 Hermitage Dr.

Delta: 1939. Hdqrs., New Orleans. Meets, 3rd Tues. PRES, R. K. Goode, 4052 Thalia St. SECY, E. H. Sanford 472 Bellaire Dr.

Shreveport: 1948. Hdqrs., Shreveport. Meets, 3rd Thurs. PRES, A. J. Jones, Jr., 753 Gladstone. SECY, J. L. Collins, Jr., 640 Delaware St.

MARYLAND

Baltimore: 1949. Hdqrs., Baltimore. Meets, 3rd Wed. PRES, F. M. Hewitt, 33 East 21st St. (18). SECY, C. H. Higdon, Jr., 709 Scarlett Dr., Towson (4).

MASSACHUSETTS

Massachusetts: 1912. Hdqrs., Boston. Meets, 3rd Tues. PRES, Roger F. Curry, 34 Sheridan Rd., Wellesley Hills (82). SECY, Ray B. Stevens, 31 Harvard St., Brookline.

Western Massachusetts: 1955. Hdqrs., Springfield. PRES, F. A. Ferraro, 293 Bridge St. SECY, J. J. Curran, 207 Liberty St. (4).

MICHIGAN

Michigan: 1916. Hdqrs., Detroit. Meets, 1st Mon. after 10th of month. PRES, K. J. Wagoner, 15370 Schaefer Hwy. (27). SECY, J. G. Black, Jr., 1200 W. Fort St. (26).

Western Michigan: 1931. Hdqrs., Grand Rapids. Meets, 2nd Mon. PRES, R. J. Weakes, 500 E. Eighth St., Holland. SECY, G. L. Jepson, 301 Henrietta St., Kalamazoo.

Society Organization Personnel

General Committees: The By-Laws provide for 9 such committees. The latest list appears in the July 1958 issue on page 148

Research Committees: The research program is under the guidance of the Committee on Research — a General Committee. The Committee on Research (see above) appoints Technical Advisory Committees as needed. The 1958 personnel appears in the June 1958 JOURNAL SECTION on page 174

Special Committees: At present there are 9 of these committees. The latest listing appears in the July 1958 issue on page 148

Standards Committee: Its subcommittees and its representatives appear in the August 1958 issue on page 166

Nominating Committee: This committee's membership is fixed by the By-Laws. The latest listing appears in the July 1958 issue on page 148

Society Regional Organization: The 1958 listing of the names of the Regional Directors and of the members of the Chapters Regional Committees was published in the May 1958 issue on page 194

Society Chapters and Branches: The Society has chartered 72 Chapters, 1 Overseas Branch, and 6 Student Branches. These groups elect their officers and governing boards. A list of the presidents and secretaries appears in this issue (see above and on the following page).

JOURNAL SECTION

MINNESOTA

Minnesota: 1918. Hdqrs., Minneapolis. Meets 1st Mon. PRES, J. H. Jester, 621 E. Hennepin Ave. SECY, J. W. McNamara, 850 Cromwell Ave., St. Paul (14).

MISSISSIPPI

Mississippi: 1953. Hdqrs., Jackson. Meets, 4th Mon. PRES, D. F. Ingram, 408 W. Fortification St. SECY, W. D. Fortner, P. O. Box 1138.

MISSOURI

Kansas City: 1917. Hdqrs., Kansas City. Meets, 1st Mon. PRES, S. C. McCann, 210 W. 10th St. (5). SECY, L. A. Heaven, 1529 Wyandotte (8).

St. Louis: 1918. Hdqrs., St. Louis. Meets, 2nd Wed. PRES, J. J. Blackmore, 4233 Chouteau Ave. (10). SECY, J. B. Killebrew, 8640 Pardee Lane (23).

NEBRASKA

Nebraska: 1940. Hdqrs., Omaha. Meets, 2nd Tues. PRES, Edwin N. Seiler, 1824 North 53rd St. SECY, William L. Ryan, 2651 St. Mary's Ave.

NEW JERSEY

North Jersey: 1952. Hdqrs., Newark. Meets, 2nd Tues. PRES, S. H. Nitzberg, P. O. Box 157, Wood Ridge. SECY, C. E. Parmelee, 85 Norwood Ave., Montclair.

NEW MEXICO

New Mexico: 1954. Hdqrs., Albuquerque. Meets, 3rd Tues. PRES, F. H. Bridgers, 213 Truman St., N.E. SECY, R. P. Lee, 114 Granite Ave., N.W.

NEW YORK

Central New York: 1944. Hdqrs., Syracuse. Meets, 4th Wed. PRES, E. L. Moyer, R.D. 2, Jamesville. SECY, R. A. Barr, 139 Dolshire Dr., N. Syracuse.

Empire State Capital: 1951. Hdqrs., Albany. Meets, 2nd Wed. PRES, E. J. Mahoney, 45 Colvin Ave. SECY, E. E. Phillips, 1206 Albany St., Schenectady.

Long Island: 1957. Hdqrs., Garden City. Meets, 2nd Mon. PRES, H. J. Campbell, Jr., 288 Old Country Rd., Mineola. SECY, J. L. Page, 41 W. 22nd St., Huntington Station.

New York: 1911. Hdqrs., New York. Meets, 3rd Mon. PRES, W. J. Olvany, 100 Charles St. (14). SECY, S. R. Apt. 36-39 205th St., Bayside (61).

Western New York: 1919. Hdqrs., Buffalo. Meets, 2nd Mon. PRES, J. P. Guerra, 34 E. Depew Ave. (14). SECY, F. R. Collins, Jr., 79 Meadow Stream Dr., Snyder (21).

NORTH CAROLINA

Northern Piedmont: 1952. Hdqrs., Greensboro. Meets, 2nd or 3rd. Fri. PRES, G. B. Rottman, 233½ N. Greene. SECY, E. A. Stroupe, Jr., P.O. Box 3135.

Southern Piedmont: 1952. Hdqrs., Charlotte. Meets, last Mon. PRES, J. R. Clark, P. O. Box 1755 (1). SECY, E. V. Overcash, P. O. Box 2155.

OHIO

Central Ohio: 1944. Hdqrs., Columbus. Meets, 3rd Mon. PRES, T. R. Walker, 182 N. Yale Ave. SECY, J. W. Ford, 2—15th Ave.

Cincinnati: 1932. Hdqrs., Cincinnati. Meets, 1st Tues. PRES, C. P. Krantz, 7612 Reinhold Dr. (37). SECY, W. H. Rieger, 1423 E. McMillan (6).

Miami Valley: 1950. Hdqrs., Dayton. Meets, 1st Wed. PRES, R. B. Walcott, 2340 E. River Rd. (39). SECY, W. H. Fogarty, 4432 Woodbine Ave. (10).

Northern Ohio: 1916. Hdqrs., Cleveland. Meets, 2nd Mon. PRES, R. A. Urban, 1740 E. 12th St. (14). SECY, B. A. Schwirtz, 2036 E. 22nd St. (15).

Toledo: 1954. Hdqrs., Toledo. Meets, 1st Mon. PRES, D. L. Wilson, 2446 Sylvania Ave. (13). SECY, E. J. Katafiasz, 1133 Radcliffe Dr. (9).

OKLAHOMA

Northeastern Oklahoma: 1948. Hdqrs., Tulsa. Meets, 2nd Tues. PRES, Jim C. Chase, 3141 East 15th St. SECY, Jack E. Tumilty, 1135 East 38th St. (5).

Oklahoma: 1935. Hdqrs., Oklahoma City. Meets, 2nd Mon. PRES, W. R. Johnson, 120 E. Main. SECY, T. L. Robinson, 313 N.W. Fourth, Suite 5.

OREGON

Oregon: 1939. Hdqrs., Portland. Meets, Thurs. after 1st Tues. PRES, W. B. Hayes, 6446 N.E. 24 (11). SECY, W. S. Cooper, 445 Pittock Block.

PENNSYLVANIA

Johnstown: 1957. Hdqrs., Johnstown. PRES, Karl O. Schlentner, 221 Central Ave. SECY, J. K. Thornton, R.D. 4, Box 230.

Philadelphia: 1916. Hdqrs., Philadelphia. Meets, 2nd Thurs. PRES, C. J. Forve, Parkwood Manor Apts., Apt. B-202, State Rd. & Penarth Ave., Upper Darby. SECY, H. N. Teuber, 17th & Federal Sts. Camden (5).

Pittsburgh: 1919. Hdqrs., Pittsburgh. Meets, 3rd Mon. PRES, E. J. Busch, 9387 Cromwell Dr. (37). SECY, G. E. Smetak, 2793 Noblestown Rd. (5).

SOUTH CAROLINA

South Carolina: 1954. Hdqrs., Columbia. Meets, 3rd Mon. PRES, H. J. Haar, Jr., Garner Rd., Rt. 6, Spartanburg. SECY, T. O. Curlee, Jr., 209 E. Stone Ave., Greenville.

TENNESSEE

Memphis: 1944. Hdqrs., Memphis. Meets, 3rd Mon. PRES, R. H. Bolding, 107 East E. H. Crump Blvd. SECY, H. W. Wade, 4711 Poplar (17).

TEXAS

Austin: 1956. Hdqrs., Austin. Meets, 3rd Thurs. PRES, J. L. Rea, Jr., Box 5206. SECY, B. J. Barnhart, 711 W. St. Johns (5).

El Paso: 1956. Hdqrs., El Paso. Meets, 3rd Mon. PRES, W. A. Byars, Jr., 937 N. Clark Rd. SECY, J. H. Brooks, 4028 Hamilton St.

Fort Worth: 1957. Hdqrs., Fort Worth. Meets, 3rd Wed. PRES, T. B. Romine, Jr., 3 Wofford Bldg., 2816 Morton. SECY, C. L. Zahn, 2509 W. Berry St. (9).

North Texas: 1938. Hdqrs., Dallas. Meets, 3rd Mon. PRES, Ross Zumwalt, 929 Mercantile Securities Bldg. (1). SECY, O. H. Mehl, 6915 Lavendale Ave. (30).

South Texas: 1938. Hdqrs., Houston. Meets, 3rd Fri. PRES, E. B. Appling, 2728 Weslayan (6). SECY, H. G. McKee, 2425 South Blvd. (6).

Southwest Texas: 1946. Hdqrs., San Antonio. Meets 3rd Tues. PRES, John G. Ford, 447 W. Hildebrand. SECY, E. E. Cravens, 722 W. Hildebrand (12).

West Texas: 1953. Hdqrs., Lubbock. Meets, 1st Tues. PRES, W. R. Anthony, 902 East 34th St. SECY, R. L. Mason, 2604 28th St.

UTAH

Utah: 1944. Hdqrs., Salt Lake City. Meets, 3rd Thurs. PRES, L. K. Irvine, 333 W. First, S., Box 2398 (10). SECY, V. Q. Tregeagle, 303 Dooly Bldg.

VIRGINIA

Virginia: 1946. Hdqrs., Norfolk. Meets, 3rd Wed. PRES, D. C. Delinger, 424 W. 21 St. (10). SECY, J. A. Hoffman, 9522 Wells Pkwy.

WASHINGTON

Inland Empire: 1950. Hdqrs., Spokane. Meets, 1st Mon. PRES, R. D. Nevers, P.O. Box 5026. SECY, R. B. Campbell, 917 W. Mallon.

Puget Sound (Formerly Pacific Northwest): 1928. Hdqrs., Seattle. Meets, 2nd Tues. PRES, M. W. McKinstry, 4017 McGilvra St. (2). SECY, K. G. Massart, 7129 44th, S.W. (6).

WISCONSIN

Wisconsin: 1922. Hdqrs., Milwaukee. Meets, 3rd Mon. PRES, R. D. Rodwell, 152 Wisconsin Ave. (3). SECY, R. I. Anderson, 8214 W. Portland Ave.

CANADA

British Columbia: 1952. Hdqrs., Vancouver. Meets, 2nd Wed. PRES., A. C. Martin, 425 W. Second Ave. (10). SECY, W. F. Wiggins, 1128 Burrard St. (1).

Chapitre de la Ville de Quebec: 1956. Hdqrs., Quebec, P.Q. PRES, Jean Veilleux, 350 E. Charest Blvd. SECY, R. A. Harnois, 604 St. John St., Rm. 203.

Manitoba: 1935. Hdqrs., Winnipeg. Meets, 4th Thurs. PRES, R. M. Fraser, 1855 Sargent Ave. SECY, W. L. Algie, 789 Niagara St. (9).

Montreal: 1926. Hdqrs., Montreal. Meets, 3rd Mon. PRES, D. J. McIntyre, Lafleur Bldg., Rm. 300, 3600 Barclay Ave. SECY, Paul Thibault, 1434 St. Catherine, W. (25).

Northern Alberta: 1956. Hdqrs., Edmonton. Meets, 3rd Wed. PRES, Edwin K. Cumming, 10249-104th St. SECY, G. N. Campbell, 10124 104th St.

Ontario: 1922. Hdqrs., Toronto. Meets, 1st Mon. PRES, John Thompson, 620 University Ave. (2). SECY, H. R. Roth, 57 Bloor St., W. (5).

Ottawa Valley: 1952. Hdqrs., Ottawa. Meets, 3rd Tues. PRES, J. Klassen, 454, Slater St. (4). SECY, C. N. Kirby 465, Gilmoor St.

Southern Alberta: 1958. Hdqrs., Calgary. PRES, H. W. Klassen, 815 Sixth St., W. SECY, P. M. Meis, 102—58th Ave., SW.

OVERSEAS BRANCH

Switzerland: 1952. Hdqrs., Zurich. PRES, Albert Eigenmann, Seestr. 105 (2). SECY Hans Kamm, Spitalgasse 30, Bern.

STUDENT BRANCHES

North Carolina State College: 1948. Faculty Adviser: Prof. R. B. Knight, M. E. Dept., Raleigh, N. C.

Oregon State College: 1949. Faculty Adviser: Prof. G. E. Thornburgh, M. E. Dept., Corvallis, Ore.

Purdue University: 1948. Faculty Adviser: Prof. F. B. Morse, M. E. Dept., West Lafayette, Ind.

Texas A. & M. College: 1946. Faculty Adviser: Prof. L. S. O'Bannon, M. E. Dept., College Station, Tex.

University of Detroit: 1949. Faculty Adviser: Prof. J. B. Olivieri, M. E. Dept., Detroit, Mich.

University of Toronto: 1951. Faculty Adviser: Prof. F. G. Ewens, M. E. Dept., Toronto, Ont., Canada.

OLD ORCHARD SHOPPING CENTER, Skokie, Ill.

Architects: LOEBL, SCHLOSSMAN & BENNETT, Chicago, Ill.
Mechanical Engineer: ROBERT E. HATTIS, INC., Chicago

(D2)

POWERS

Air Conditioning Control HELPS MAKE SALES in Leading Shopping Centers

It's a Pleasure to Shop in air conditioned stores equipped with Powers comfort control. Shoppers spend more freely and owners spend less for maintenance. Some prominent users of Powers temperature control are listed below:

Northland Shopping Center, near St. Louis
Gulfgate Shopping Center, near Houston
7-Corners Shopping Center, near Washington, D. C.
Macy's at Roosevelt Field Shopping Center, N. Y.
Famous-Barr Stores, St. Louis
Gimbels, in Cheltenham and Philadelphia
I. Magnin & Company, Los Angeles
Nieman-Marcus Co., Dallas
Rich's, Atlanta, Georgia
Sakowitz Bros., Houston
Saks Fifth Ave., New York — White Plains
Sears, "World's largest store", many large stores in U. S. and Latin America
John Wanamaker Stores in Wynnewood, Pa., Baederwood, Pa., and Wilmington, Del.
In CANADA: **T. Eaton Co., Ltd.,** 6 stores
Simpson-Sears, 12 Stores • **Robert Simpson Co., Ltd.**
Dupuis Freres, Montreal

At Old Orchard Shopping Center

Powers control is used in —

Marshall Field & Co.

CRAB APPLE RESTAURANT in the Sun Room, the Apple Basket, Countryman's Grill and in the deluxe Le Manoir, with its continental cuisine.

Also in the following stores: THE FAIR • HIRSCH • ARCADE SHOPS • JOHN M. SMYTH CO. In the 7 story PROFESSIONAL BUILDING conditioned air for the interior zones is controlled by Powers.

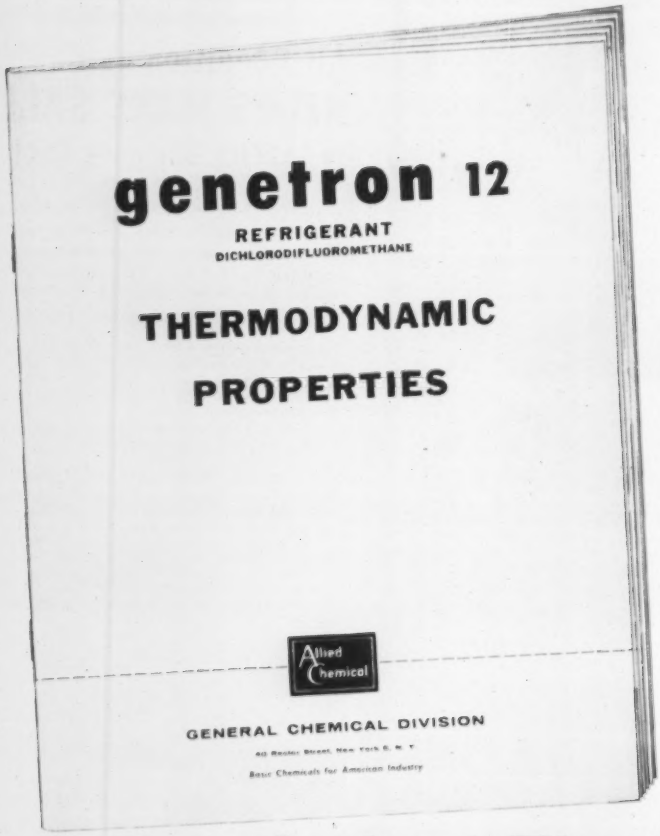
For Your New Building, be it a school, factory, hospital, church or commercial building ask your architect or engineer to include a Powers Quality system of temperature and humidity control. Its dependable year after year operation and low maintenance cost make it a highly profitable investment.

THE POWERS REGULATOR CO.

SKOKIE, ILL. | *Offices in 85 cities in U.S.A. and Canada* | *See your Phone Book*

Automatic Temperature and Humidity Control Since 1891

NEW! *from General Chemical research...*



Here are essential new data for every refrigeration engineer—on dichlorodifluoromethane, the most widely used fluorinated hydrocarbon refrigerant.

Latest Thermodynamic Tables on genetron® 12

Dichlorodifluoromethane

These new 36-page tables offer a number of important advantages over tables previously available:

1. Electronic computation completely eliminates computational inaccuracies.
2. Data are the best available, including new thermal data based on spectroscopic measurements.
3. The temperature range for superheat properties has been expanded in the most useful ranges; pressure intervals have been decreased. Saturated properties range from −150°F to 215°F in 1°F intervals. Superheat properties range from 0.1 to 500 psia.

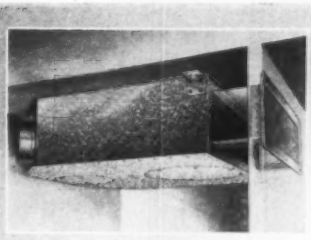
WRITE TODAY (on business letterhead, please) for these important tables. We will be glad to send you free copies.

ALSO AVAILABLE! New thermodynamic tables released early this year on "Genetron" Super-Dry Refrigerants 11 and 22. If you do not already have copies of these tables, write for all three!

genetron®
SUPER-DRY REFRIGERANTS

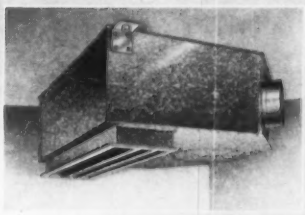
Allied Chemical

GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N.Y.



GRILLE MODEL
in six sizes
80-1500 cfm air delivery

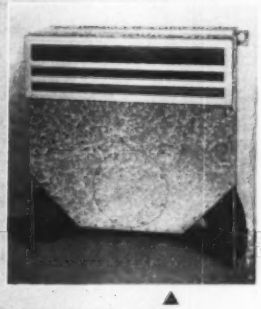
LINEAR DIFFUSER MODEL
in three sizes
80-450 cfm air delivery



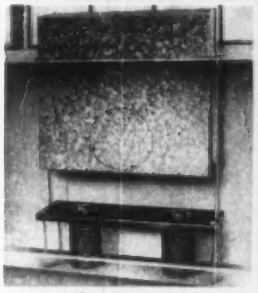
CONNOR ENGINEERING CORPORATION

kno·draft®

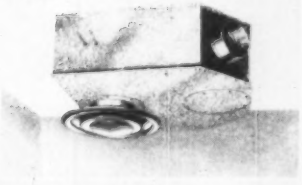
HIGH VELOCITY VALVE ATTENUATORS



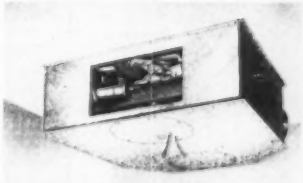
UNDER-WINDOW MODEL
in three sizes
80-450 cfm air delivery



REMOVABLE UNDER-WINDOW MODEL
in three sizes
80-450 cfm air delivery



DIFFUSER MODEL
in six sizes
80-1500 cfm air delivery



OPEN END MODEL
in six sizes
80-1500 cfm air delivery
Rectangular and Multiple Round Outlets

NOW! ALL SIX MODELS offer greatest design flexibility for single and dual duct systems

All six high performance, space-saving, cost-saving models are available with Constant Volume Control . . . with either flat plate or sinuous baffle . . . with static pressure taps for quick accurate air delivery measurement . . . and with the patented helical spring damper that assures complete close-off.

Wherever your plans call for a high velocity air conditioning system—whether you're designing a new structure or remodeling an old one—choose Connor high velocity valve attenuators . . . there's a model that meets every design and performance test.

Request new 24 page Bulletin K33-A, which includes selection data on Connor equipment and special information for the design of *any* High Velocity system.

CONNOR... for Constant Comfort Conditions

CONNOR ENGINEERING CORPORATION

kno·draft®

high velocity air diffusers

CONNOR ENGINEERING CORPORATION
82 SHELTER ROCK ROAD • DANBURY • CONNECTICUT

MAIL TODAY

CONNOR ENGINEERING CORPORATION
82 SHELTER ROCK ROAD, DANBURY, CONNECTICUT

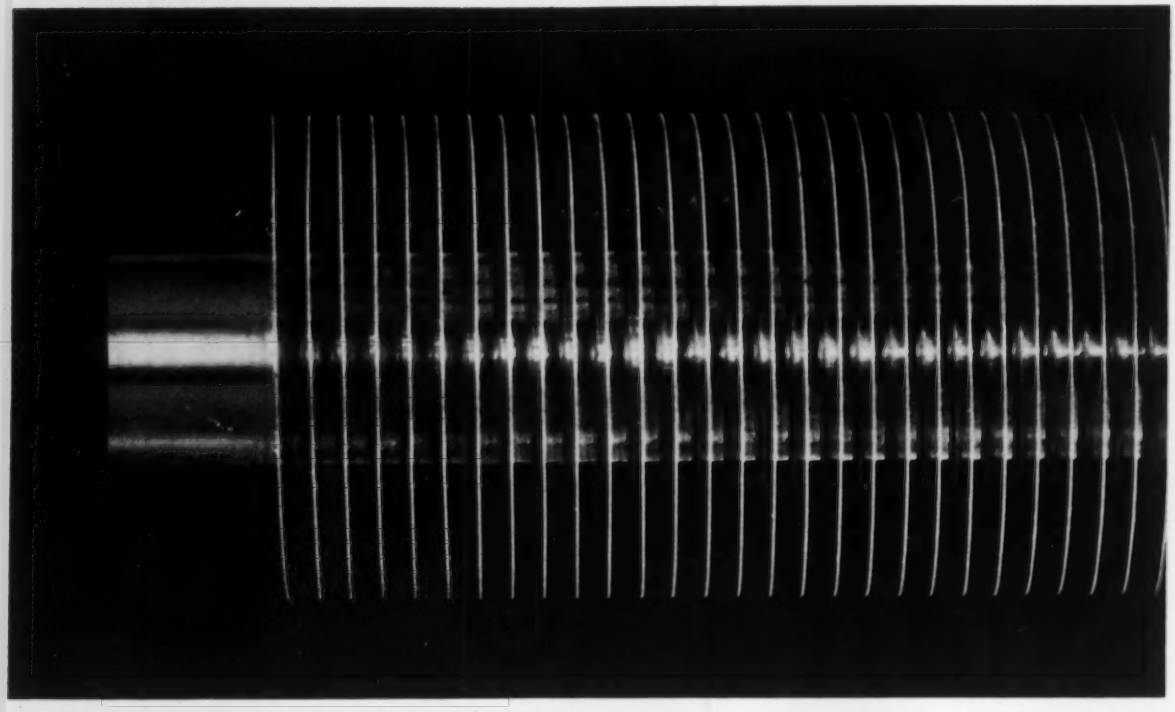
Please send me New 24 page Bulletin K33-A.

NAME .....

COMPANY .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....



AEROFIN
Smooth-Fin Coils offer you

Greater Heat Transfer
per sq. ft. of face area

Lower Airway Resistance
—less power per c.f.m.

Aerofin smooth fins can be spaced as closely as 14 per inch with low air friction. Consequently, the heat-exchange capacity per square foot of face area is extremely high, and the use of high air velocities entirely practical. Tapered fin construction provides ample tube-contact surface so that the entire fin becomes effective transfer surface. Standardized encased units arranged for simple, quick, economical installation.

Write for Bulletin S-55

AEROFIN CORPORATION

101 Greenway Ave., Syracuse 3, N. Y.

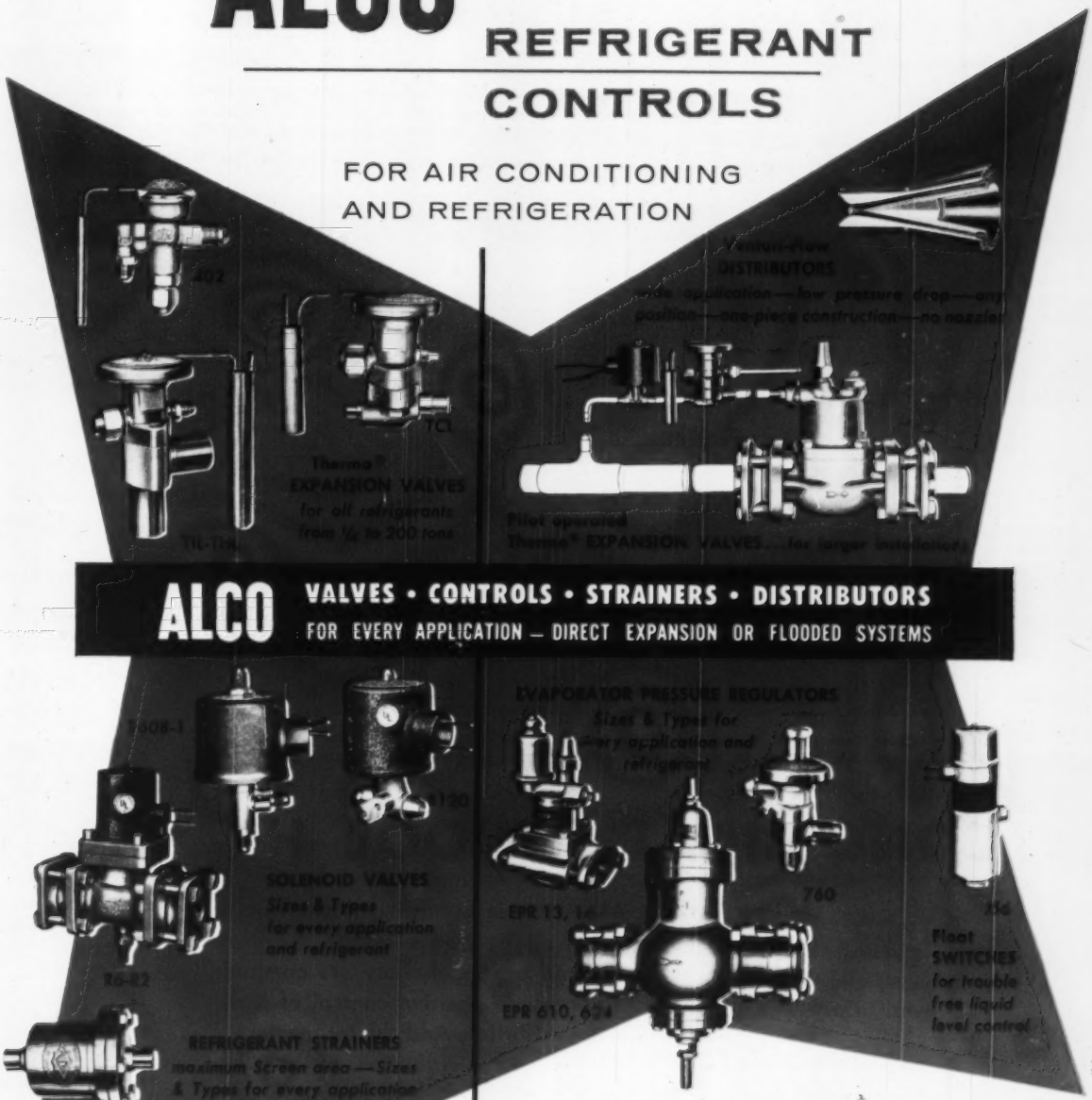
Aerofin is sold only by manufacturers of fan system apparatus. List on request.

ALCO

the one complete line of

REFRIGERANT CONTROLS

FOR AIR CONDITIONING AND REFRIGERATION



ALCO VALVES • CONTROLS • STRAINERS • DISTRIBUTORS
FOR EVERY APPLICATION — DIRECT EXPANSION OR FLOODED SYSTEMS

Use and Specify ALCO Controls
the one complete line designed and engineered for efficient trouble free performance.

See your Alco Wholesaler —
Write for Specification Details

ALCO

•*BUY SECURITY*
•*BUY QUALITY*
•*BUY ALCO*

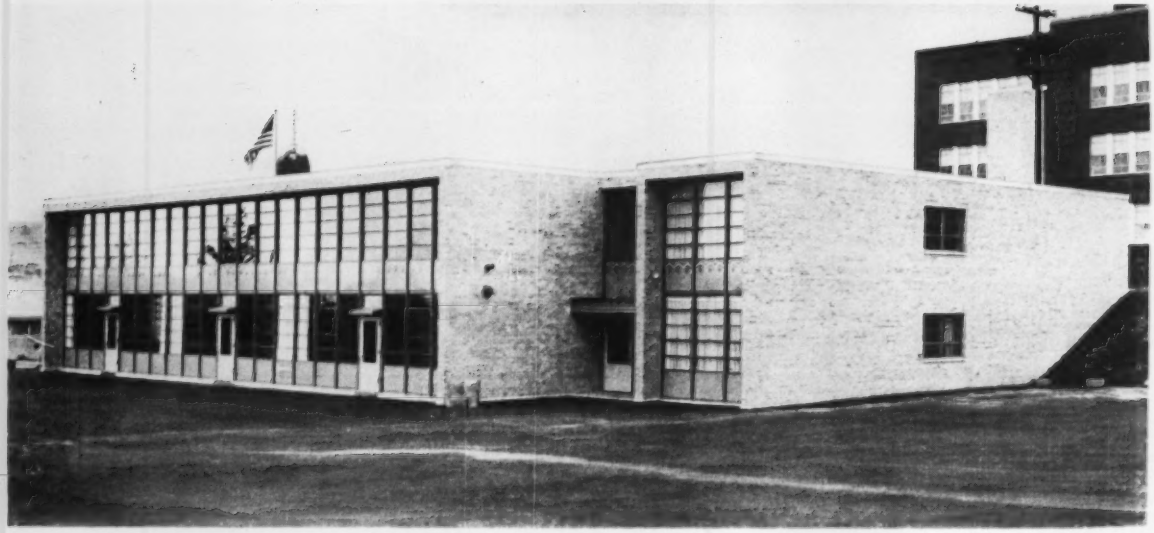
7944

ALCO VALVE CO.
1461 KINGSLAND AVE. • ST. LOUIS 5, MO.

The one complete line of refrigerant controls: Thermostatic Expansion Valves · Refrigerant Distributors · Solenoid Valves · Suction Line Regulators · Flooded Evaporator Controls and Reversing Valves

Campbell

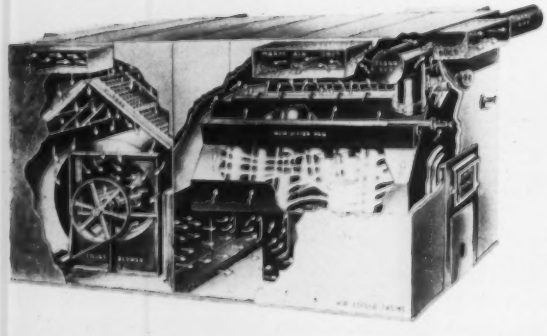
WARM AIR HEATERS FOR LARGE BUILDINGS



St. Joseph's School, Endicott, N. Y., heated with a Campbell No. 8150 gas-fired heater, installed in 1956. Architect, Walter Paul Bowen, Binghamton, N. Y. Heating contractor, A. R. Green & Sons, Binghamton.

ECONOMICAL SCHOOL HEATING

Low in first cost — low in operating costs, Campbell Heaters make warm air heating of large multi-room buildings both easy and practical. They are compact, easily installed. They provide positive control of temperature, humidity and ventilation. And the large silent blower assures quick, efficient distribution of heat. Campbell Heaters available for all fuels in capacities up to 3,150,000 BTUs.



MANUFACTURERS' AGENTS

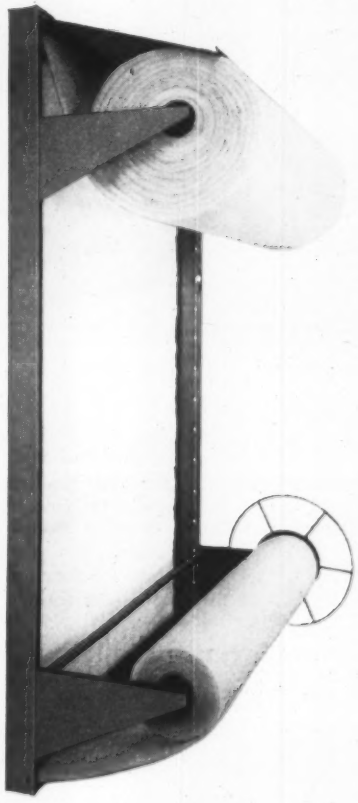
We have some attractive openings for men calling on heating contractors and architects.

CAMPBELL HEATING COMPANY

Des Moines 17, Iowa

NEW CONOMANUAL

OUTMODES UNIT FILTER PANELS!



Now...WHATEVER THE PRICE LIMIT... you can CLEAR THE AIR with a Continental roll-away type air filter.

Choose between CONOMATIC and the new, different CONOMANUAL!

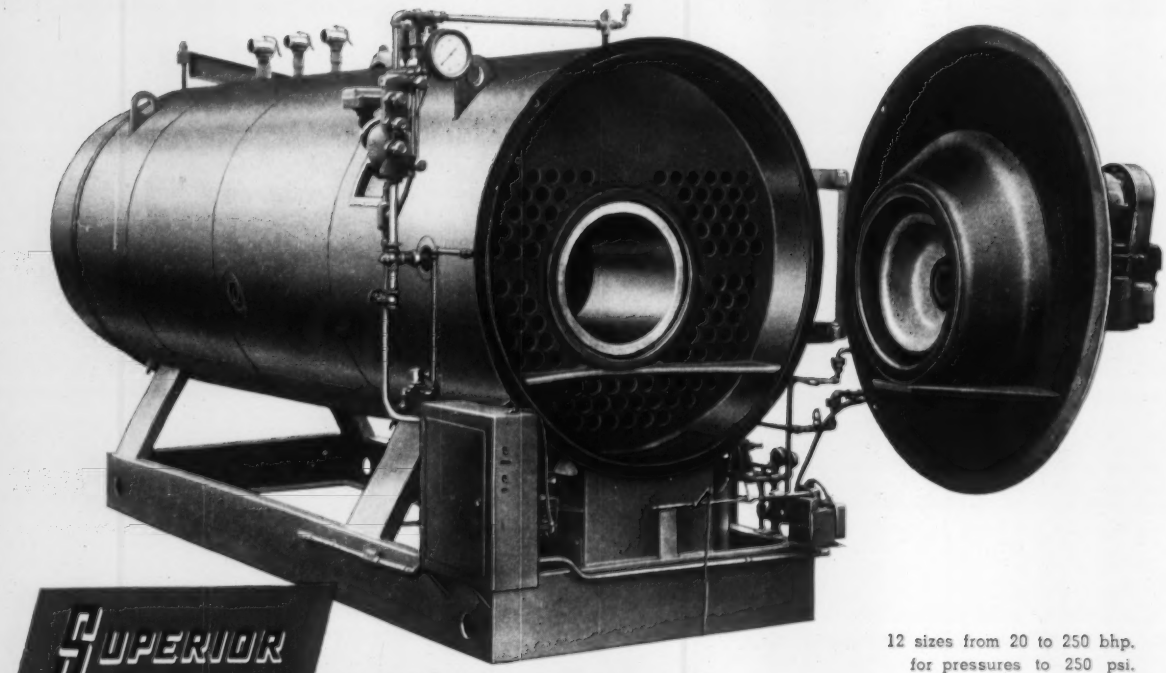
CONOMANUAL is the only hand-operated, roll-away type, viscous impingement filter to be designed especially for low-cost or auxiliary installations. It assures maximum economy and ease of maintenance, yet provides the cleanliness and efficiency that until now were possible only with the more expensive *automatic* filters.

CONOMANUAL's new *synthetic* media is moisture-, fungus-, and fire-resistant. Used portion rolls neatly inward to prevent soiling hands or clothes at replacement time.

CONOMANUAL requires no servicing except to advance the blanket periodically and replace it when expended.

For complete details ask your nearest Continental representative for Bulletin No. 850, or write direct to

SO EASY TO MAINTAIN ITS NEW EFFICIENCY



SUPERIOR "COMPACT"

12 sizes from 20 to 250 bhp. for pressures to 250 psi. or for hot water. Fully automatic operation firing oil or gas or both. Before you buy or specify any packaged boiler, get the details in Bulletin 1004-C

all the big boiler features you want combined with accessibility and easy maintenance

With a full 5 sq. ft. of heating surface per bhp., 4-pass, down-draft design, and built-in induced draft, the Superior COMPACT is a highly efficient and dependable package. Its efficiency, guaranteed by factory-fire-test of every unit, insures years of economical performance; for the Superior COMPACT is planned for the easy maintenance which sustains high efficiency.

Front doors are hinged, and rear doors hinged or davited to simplify inspection and cleaning. But note that no belts or mechanical components are located inside the front door where they would be subject to the heat of the fire. All units firing #4, #5 and #6 oil are equipped with dependable Superior Rotary Burners. High in the shell, and protected by the tubes of the fourth pass, the furnace is away from the "danger zone" eliminating the possibility of bagging or blistering.

Specialists in PACKAGED BOILERS... exclusively

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

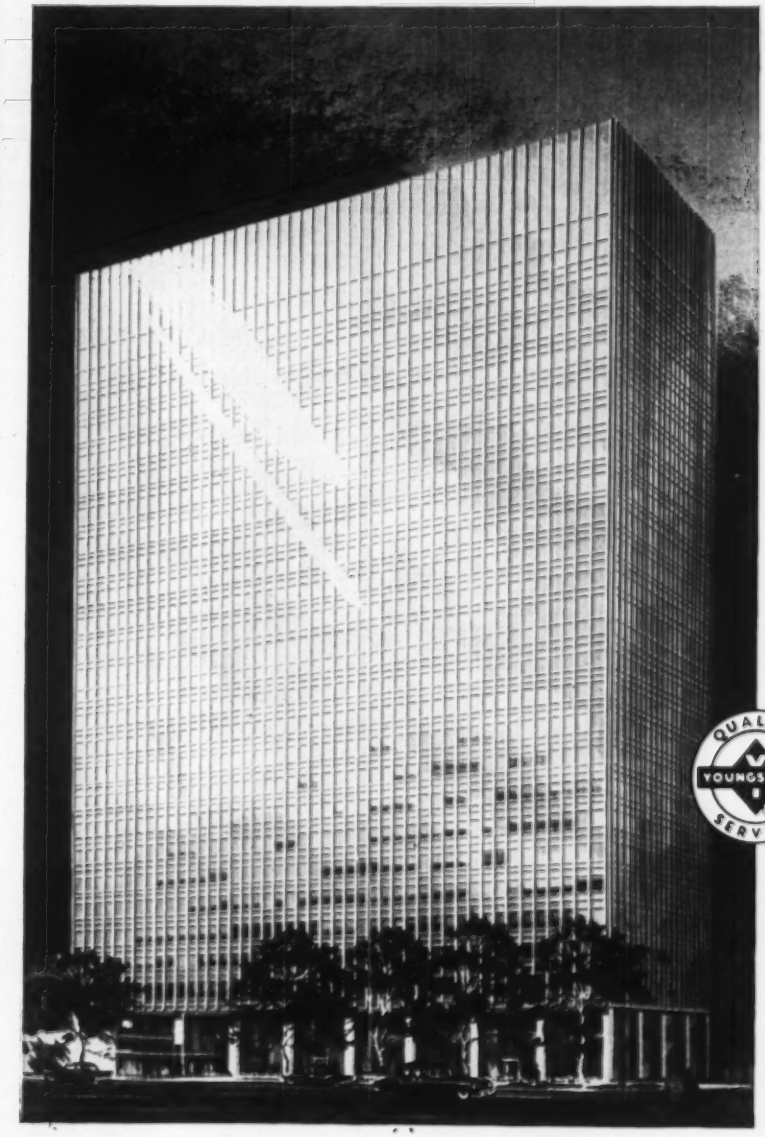
SUPERIOR PACKAGED BOILERS

Cleveland's "Modern as Tomorrow"

ILLUMINATING BUILDING

uses Youngstown Steel Pipe

Building Owner: 55 Public Square, Inc., New York, N Y
(A Vincent Astor-Brooks, Harvey & Company enterprise)
Rental and Managing Agents Ostendorf-Morris Company, Cleveland, Ohio
Architect: Carson & Lundin, New York, N Y
General Contractor George A Fuller Company, New York, N. Y.
Structural & Mechanical Engineers: McGeorge Hargett & Associates
Consulting Mechanical Engineers Jaros, Baum & Bolles
Heating & Air Conditioning Contractor: The Feldman Bros. Company, Cleveland, Ohio
Distributor: Grinnell Company, Cleveland



Cleveland's newest architectural beauty — this modernistic 22-story Illuminating Building — will provide much-needed air-conditioned office space for the "Best Location in the Nation". Owner of the new structure, 55 Public Square, Inc., and the architects, wisely chose Youngstown Steel Pipe to provide for a long-lived, dependable water supply system.

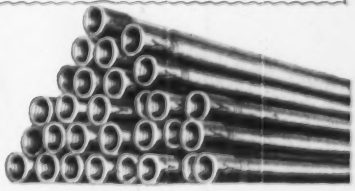
Youngstown Steel Pipe is the best pipe obtainable—anywhere. That's because it's made from our highest quality steel by men who have devoted their lives to the pipemaking business. Each and every step in Youngstown's completely integrated operations is closely quality-controlled by expert metallurgists to guarantee pipe that will meet your most exacting specifications.

Your nearby Youngstown Pipe Distributor has complete and ample stocks in all sizes. Why not call him today and discuss your requirements?

Specify Youngstown and secure these
7 Points of uniform goodness

uniform ductility
uniform lengths
uniform threading
uniform weldability
uniform wall thickness and size
uniform strength and toughness
uniform roundness and straightness

QUALITY YOUNGSTOWN SERVICE



THE YOUNGSTOWN SHEET AND TUBE COMPANY

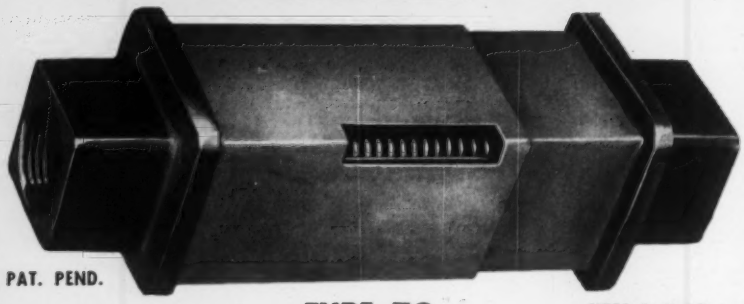
Manufacturers of
Carbon, Alloy and Yoloy Steel
General Offices - Youngstown 1, Ohio
District Sales Offices in Principal Cities

Keflex QUADRA-SIDE

Telescopic Expansion Compensators

WITH LAMINATED STAINLESS STEEL BELLOWS, 2 PLY OR MORE

. . something new for the ARCHITECT — ENGINEER — CONTRACTOR

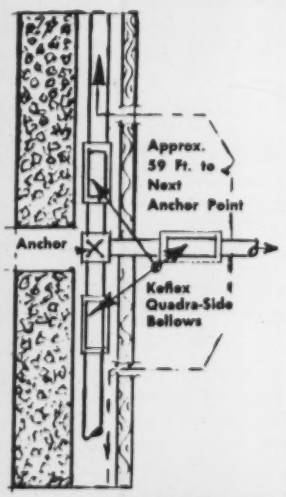


PAT. PEND.

TYPE 7Q SIZES ¾"-3" Inc.

Working Pressure 300 P.S.I. — Temperature to 800°F. — Has Reserve Strength — Not Just Borderline Prospect of Withstanding Effect of Pressure — Shock — Thermal Line Expansion — High Temperature — Moderate Vibration.
HIDDEN PROTECTION PLUS! All Non Corrosive Stainless Steel Bellows With Brass or Bronze End Fittings and Telescopic Shrouds.

KEFLEX FITS IN NARROWEST WALL SPACE—SAFE—PERMANENT



● **ROUND** KEFLEX Bellows are made of Laminated Stainless Steel, multiple ply (usually 2 ply or more) for greater strength with minimum force required to move bellows. The minimum force to move 7 Q Keflex Bellows greatly reduces the need for additional anchoring above that required to handle line pressure thrust force as the force to move Keflex 7 Q only is always less than 100 lbs.

● **FLAT** KEFLEX FLAT GUIDES offer so many advantages it is difficult to mention them all. Briefly: The KEFLEX FLAT OUTSIDE GUIDE (shroud) is made of brass USUALLY formed square of required length —one unit end will telescope over other unit end. The flat surfaces slide over and in one another—practically eliminating possibility of torque as result of faulty installation. This ASSISTS PROPER GUIDING.

● **SQUARE** KEFLEX SQUARE END FITTINGS are made of heavy, non-porous, square, bronze stock, and threaded tapered female pipe size. They are attached to the KEFLEX 7 Q bellows and the outside guides by silver brazing. The result is an easy moving expansion joint that will absorb either the slightest or the greatest thermal pipe expansion and with practically no load on the anchors. The heavy bronze ends, which will not crush during normal installations, assures safe and leakproof joints.

▸▸▸ WRITE TODAY FOR LITERATURE

U. S. FLEXIBLE METALLIC TUBING CO.

SINCE 1905

KEFLEX MANUFACTURING DIVISION
454 EAST THIRD STREET, LOS ANGELES 13, CALIFORNIA

SAN FRANCISCO 5 — 63 MAIN ST.
PORTLAND 9, OREGON — 328 N.W. BROADWAY
SEATTLE 4, WASHINGTON — 2425—6TH AVE. S.

THE DISTRICT HEATING HAND BOOK

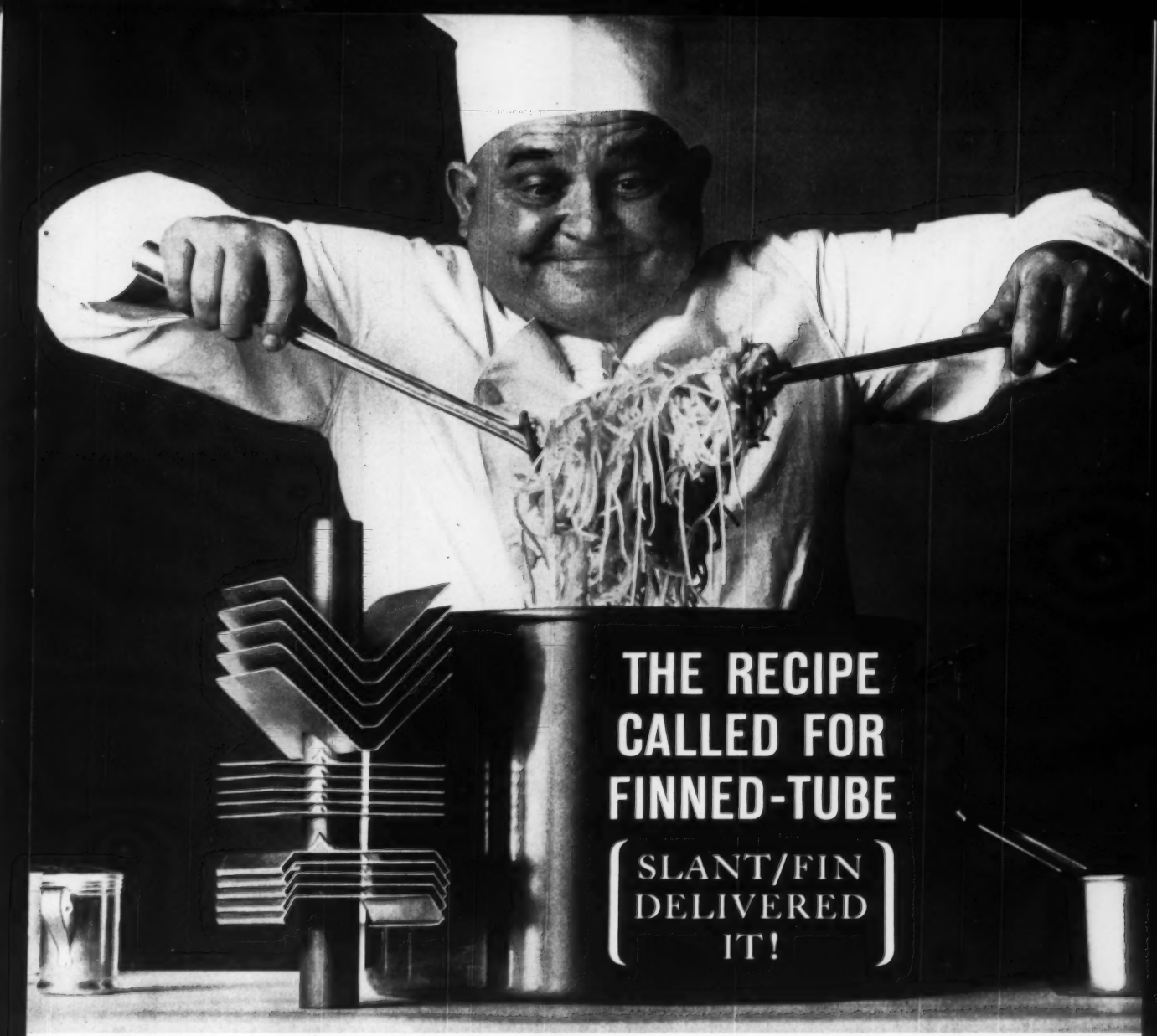
THIRD EDITION

A Revised Volume — 529 Pages
15 CHAPTERS — 6"x9¼"

GROWTH AND PRESENT STATUS
ECONOMICS OF DISTRICT HEATING
GENERAL DATA
DISTRICT HEATING PLANTS
WATER CHEMISTRY AND CORROSION
STEAM DISTRIBUTION
METERING
BUILDING HEATING SYSTEMS
CONSUMERS' PROCESS EQUIPMENT
CONSUMERS' ACCESSORY EQUIPMENT
ESTIMATING STEAM REQUIREMENTS
ECONOMICAL USE OF STEAM
RATES
SALES ACTIVITIES
HOT WATER FOR DISTRICT HEATING

Price $7.00

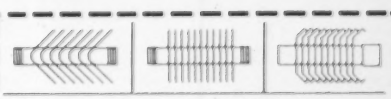
NATIONAL DISTRICT HEATING ASSOCIATION
827 N. EUCLID AVE.,
PITTSBURGH 6, PA.



THE RECIPE CALLED FOR FINNED-TUBE

[SLANT/FIN DELIVERED IT!]

Recently, Slant/Fin designed and manufactured a special finned-tube element for use in a new spaghetti manufacturing process. We're told it's been responsible for a whole new flavor quality in a leading brand name product. Although a somewhat unusual application, it is by no means an uncommon request. ■ In recent years we have designed and manufactured extended-surface tubing for many special industrial requirements. Today Slant/Fin products are in use on land, sea and in the air. For example: two continuous miles of finned-tube provide accurate temperature control for a textile drying process; all-copper finned-tube heats modern ferry boats; lightweight aluminum finned-tube provides passenger comfort in executive aircraft; and Slant/Fin designed stainless steel finned-tube is specified for atomic energy installations. ■ The reason so many designers and engineers consult Slant/Fin is that Slant/Fin's manufacturing processes are completely flexible. Slant/Fin products are design-engineered to fully exploit the physical and structural properties of the materials employed. They are offered in three basic fin shapes: the V-shape, the modified V-shape and the square-finned "SQ" series. ■ If you are considering any process or system that calls for finned-tube fabricated from unusual metals or metal combinations, why not submit your requirements to us today? It's easily done — use this coupon or write in detail to the Slant/Fin Engineering Division.



Gentlemen — I am interested in special process applications of finned pipe for use in:

_____

_____

Please have a representative contact me.

Name_____

Title_____

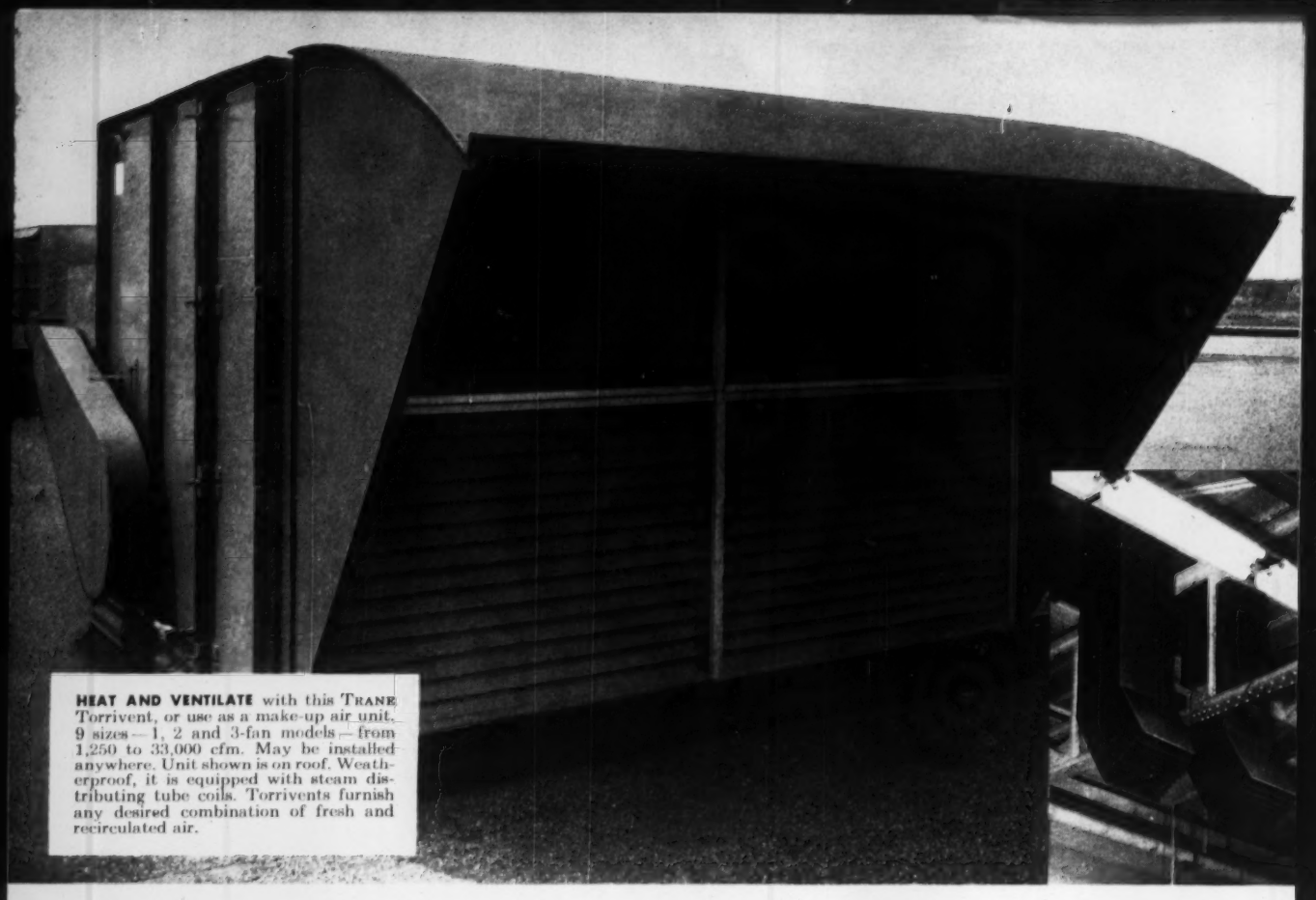
Firm_____

Address_____

City_____ State_____

Slant/Fin

RADIATOR CORP., ENGINEERING DIVISION
87-49 | 130th Street, Richmond Hill 18, N. Y.



HEAT AND VENTILATE with this TRANE Torrivent, or use as a make-up air unit. 9 sizes—1, 2 and 3-fan models—from 1,250 to 33,000 cfm. May be installed anywhere. Unit shown is on roof. Weatherproof, it is equipped with steam distributing tube coils. Torrivents furnish any desired combination of fresh and recirculated air.

Stop cold air infiltration in plants quickly, simply with a Trane Torrivent!

Rugged, big-volume heating-ventilating units supply make-up air to equalize exhaust-system loss

Here's how to solve the problem of discomfort conditions caused by adding exhaust equipment to plant heating-ventilating systems. When drafts, uneven heating result from cold air infiltrating around doors and windows, use rugged, high-volume TRANE Torrivent units to supply make-up air, create a positive instead of a negative pressure within the building.

The TRANE Torrivent both heats *and* ventilates. It delivers a large volume of air—fresh or recirculated—heated to uniform temperatures and delivered at uniform velocities. The Torrivent is widely used for curing and drying processes, too. And its exceptionally quiet operation makes it especially suitable for schools, institutions and auditoriums where a high noise level would be objectionable.

Guard against cold air infiltration the next time you plan a job—or correct this condition when it occurs—by incorporating a TRANE Torrivent into the heating-ventilating system. The Torrivent will offset exhaust-system heat loss, provide uniform comfort with lower fuel costs.

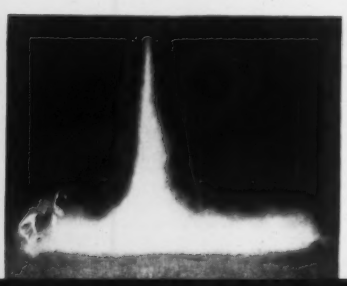
WANT MORE FACTS? For complete information on the Torrivent and other heating-ventilating equipment, call your nearby TRANE Sales Office. Or write TRANE, La Crosse, Wisconsin.

For any air condition, turn to

TRANE

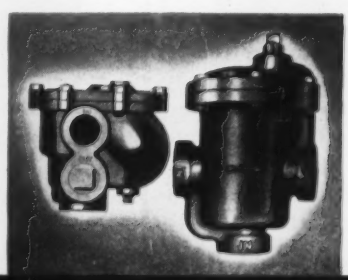
MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO • 97 U.S. AND 18 CANADIAN OFFICES



Any Heating Pattern is possible with this TRANE Projection Unit Heater! Exclusive diffusion features provide an almost unlimited number of heating patterns. Projection and Horizontal types available for any application.

Matched Equipment for *all* heating, ventilating equipment! The new, redesigned line of TRANE Steam Specialties saves fuel, gives you *matched* equipment for every job. Traps, strainers, valves, vents for any type of system.



Mr. Mulligan gets technical help the easy way

THAT EVENING...
BOY, THIS IS PRETTY COMPLICATED...MAYBE I CAN GET HELP FROM THE MANUFACTURERS
MULLIGAN REFRIGERATING CO. P. MULLIGAN PRES.

NEXT DAY...
GEE, THESE MANUFACTURERS ARE HARD TO GET HOLD OF
WE'RE SORRY, MR. MULLIGAN, BUT OUR MAN WON'T BE OUT IN YOUR TERRITORY UNTIL NEXT WEEK
GUESS WE'LL HAVE TO HIRE AN ENGINEER

WELL, I'LL JUST HAVE TO TURN THIS JOB DOWN...AND IT WAS A BIG CONTRACT, TOO
DON'T GIVE UP, MR. MULLIGAN, WHAT YOU NEED IS THE TECHNICAL HELP THAT A COMPLETE AIR CONDITIONING AND REFRIGERATION WHOLESALER CAN GIVE YOU
HELP WANTED
ABC REFRIGERATION SUPPLY CO.

YOU MEAN I WON'T HAVE TO HIRE A TECHNICIAN?
RIGHT! WE HELP YOU WITH EQUIPMENT SELECTION, PRICE QUOTATIONS, OR ANY TECHNICAL PROBLEMS YOU MAY HAVE
HELP WANTED

ABC REFRIGERATION SUPPLY CO.? GOT ANOTHER SPECIAL JOB HERE...COULD YOU GIVE ME SOME INFORMATION ON XYZ EQUIPMENT?
SURE CAN!
COMPLETE AIR CONDITIONING & REFRIGERATION WHOLESALER
HEADQUARTERS FOR FREON REFRIGERANTS

YOU SAVE TIME, YOU SAVE MONEY when you buy from your complete air conditioning and refrigeration wholesaler. When you need a refrigerant, be sure you always ask for Freon*. It's the refrigerant backed by more than 26 years of Du Pont technical and manufacturing leadership. "Freon" is the refrigerant that sets the industry's standards for purity and dryness.

SALES AGENTS: Ansul Chemical Co., Marinette, Wisconsin; and Virginia Smelting Co., West Norfolk, Virginia

Buy where you see this sign...

FREON® REFRIGERANTS

**Freon and combinations of Freon- or F- followed by numerals are Du Pont's registered trademarks for its fluorinated hydrocarbon refrigerants.*

DU PONT

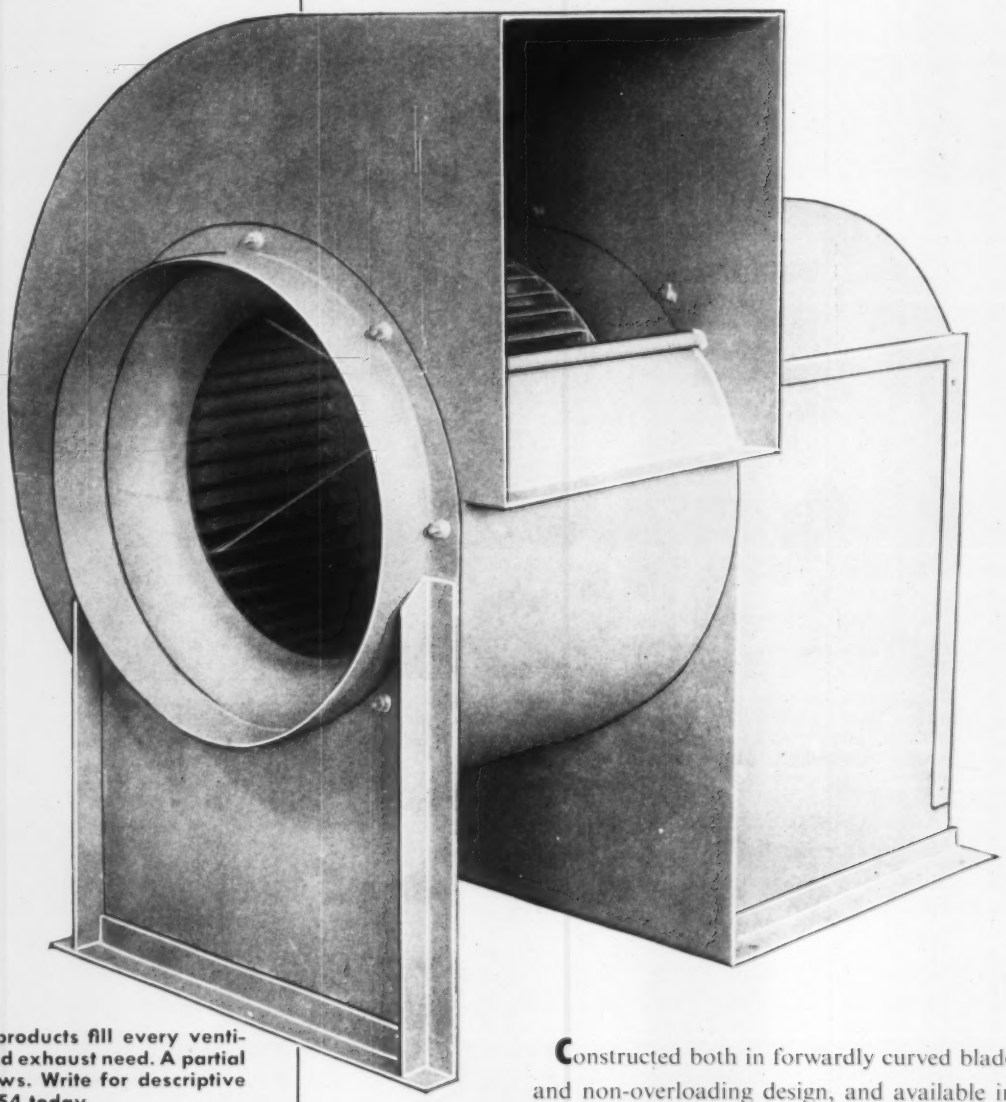
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

If you need to move air...

BARRY

Belted Ventilating Sets do it BEST!



BARRY products fill every ventilation and exhaust need. A partial list follows. Write for descriptive bulletin 54 today.

FC ventilating fans
Induced draft fans
Steel plate fans
Fan wheels and scrolls
BBC ventilation fans
Forced draft fans
Fume exhaust fans
Utility exhausters
Belted ventilating sets
Material handling fans
Medium pressure blowers
Special applications

Constructed both in forwardly curved blade and non-overloading design, and available in 12 sizes to 22,000 cfm, Barry designed units perform your specific job easily and economically . . . Because they are convertible in discharge for ready adaptability, Barry belted ventilating sets get your installations into efficient operation in record time.

BARRY BLOWER CO.

3102 CALIFORNIA ST. N. E. • MINNEAPOLIS 18, MINN.

Member: Air Moving and Conditioning Association, Inc.

School Job — Nebraska

Brownell Hall School,
Omaha, Nebraska
Boyer, Biskup & Widstrom,
architects;
Nance Eng. Co.,
engineers;
Parsons Const. Co., gen. contractor;
Nebraska Sheet Metal of Omaha,
heating contractor

SONOCO
SONOAIRDUCT®
FIBRE DUCT

Installed as supply lines in this Omaha school!

The installation is typical of the widespread use of SONOAIRDUCT fibre duct by contractors who have found they can save time and labor, without lowering the quality of construction. Duct sizes ranging up to 26″ I.D. were used on this job.

Economical SONOAIRDUCT fibre duct is ideal for slab floor perimeter heating or combination heating and cooling systems where duct is encased in concrete. 23 sizes, 2″ to 36″ I.D., in standard shipping lengths of 18′. Special lengths also available, which can be easily cut to exact size on the job. Meets and exceeds F.H.A. criteria and test requirements for products in this category. Free installation manual. See our catalog in Sweet's.

For complete information and prices, write—

SONOCO
Construction Products

- HARTSVILLE, S. C.
- LA PUENTE, CALIF.
- MONTCLAIR, N. J.
- AKRON, INDIANA
- LONGVIEW, TEXAS
- ATLANTA, GA.
- BRANTFORD, ONT.
- MEXICO, D.F.

1874

SONOCO PRODUCTS COMPANY

ANEMOSTAT reports on All-Air High Velocity Systems

Selection Manual No. 60 will be sent to you promptly on request.

Anemostat Corporation of America pioneered the development of All-Air High Velocity Systems. Anemostat leadership in high velocity systems has resulted in more than 500 fine installations using more than 60,000 units in office buildings, schools, hospitals, auditoriums, etc. throughout the United States, Canada and Mexico.

Anemostat Selection Manual No. 60 contains complete information on the many architectural and engineering advantages of the Anemostat All-Air High Velocity System.

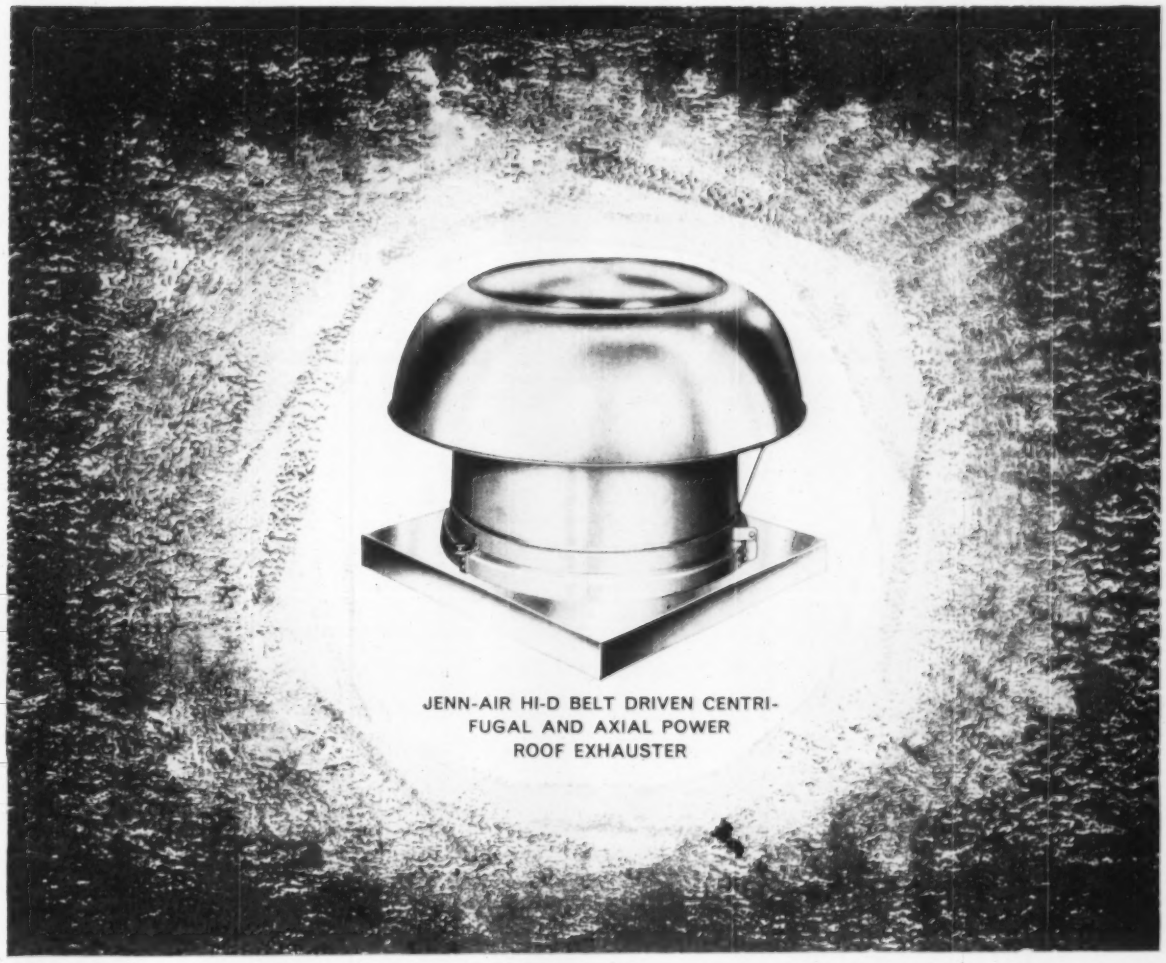
ANEMOSTAT®

DRAFTLESS *Aspirating* AIR DIFFUSERS

ANEMOSTAT CORPORATION OF AMERICA

10 EAST 39th STREET, NEW YORK 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES



JENN-AIR HI-D BELT DRIVEN CENTRIFUGAL AND AXIAL POWER ROOF EXHAUSTER

Hi-D MEANS HIGH DISCHARGE and LOWER ROOF MAINTENANCE

HI-D CENTRIFUGAL POWER ROOF EXHAUSTER
Unit in open position, showing ready access to drive assembly.

HI-D AXIAL POWER ROOF EXHAUSTER
Unit in open position, showing ready access to drive assembly.

New JENN-AIR aluminum belt-driven units meet industry's need for exhausters that combine high discharge with low contour appearance.

Often times it is advantageous to avoid direct discharge of air onto a built-up roof. Hi-D with no increase in curb height averages double the discharge height of ordinary fans. It likewise offers advantages in areas where drifted snows require higher discharge height. Ordinarily this would mean the use of higher curbs and unsightly projection above the roof line. Once you compare, you will decide on Jenn-Air.

JENN-AIR PRODUCTS COMPANY, INC.
1102 Stadium Drive, Indianapolis 7, Indiana

"Off-the-shelf" delivery

— another example of how you benefit when you select American Blower heating equipment

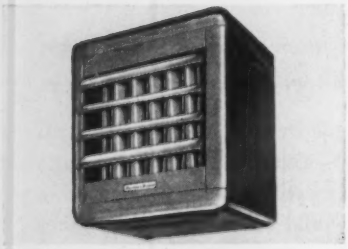
It's a *wide-open* market. Unit heaters are going into most new commercial and industrial buildings . . . and they're used extensively for modernization. Pick up your full share of the profits! Sell competitively priced American Blower Venturafin® Unit Heaters. Both vertical and horizontal designs are available for "off-the-shelf" delivery from *local* stocks.

Sales points: Venturafin Unit Heaters waste no floor or wall space, warm without time lag to ideal comfort conditions, can fit into steam or hot-water systems. And they offer your customers these other important benefits:

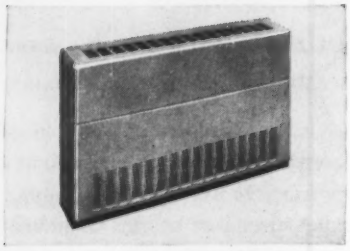
- **Packaged heating** — fast installation. Complete, ready to use with simple connections to steam or hot water.
- **Pre-engineering** — sizes to handle all requirements. Just pick the right unit from the catalog. No on-the-job engineering required.
- **Certified ratings** — meet rigid unit-heater test codes.

Add to your profits. Sell the complete line of American Blower Heaters. Get details from your distributor, or write us direct: American-Standard,* American Blower Division, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

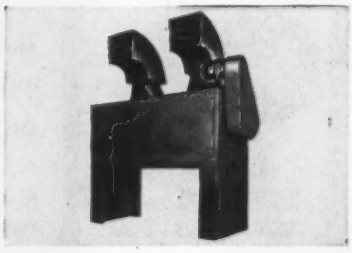
It pays to standardize on American Blower!



Gas-fired unit heaters — rugged; 50,000 to 230,000 Btu/hr. input.



Cabinet heaters — attractive, quiet. Models for steam or hot water.



Industrial heaters—available through American Blower branch offices.

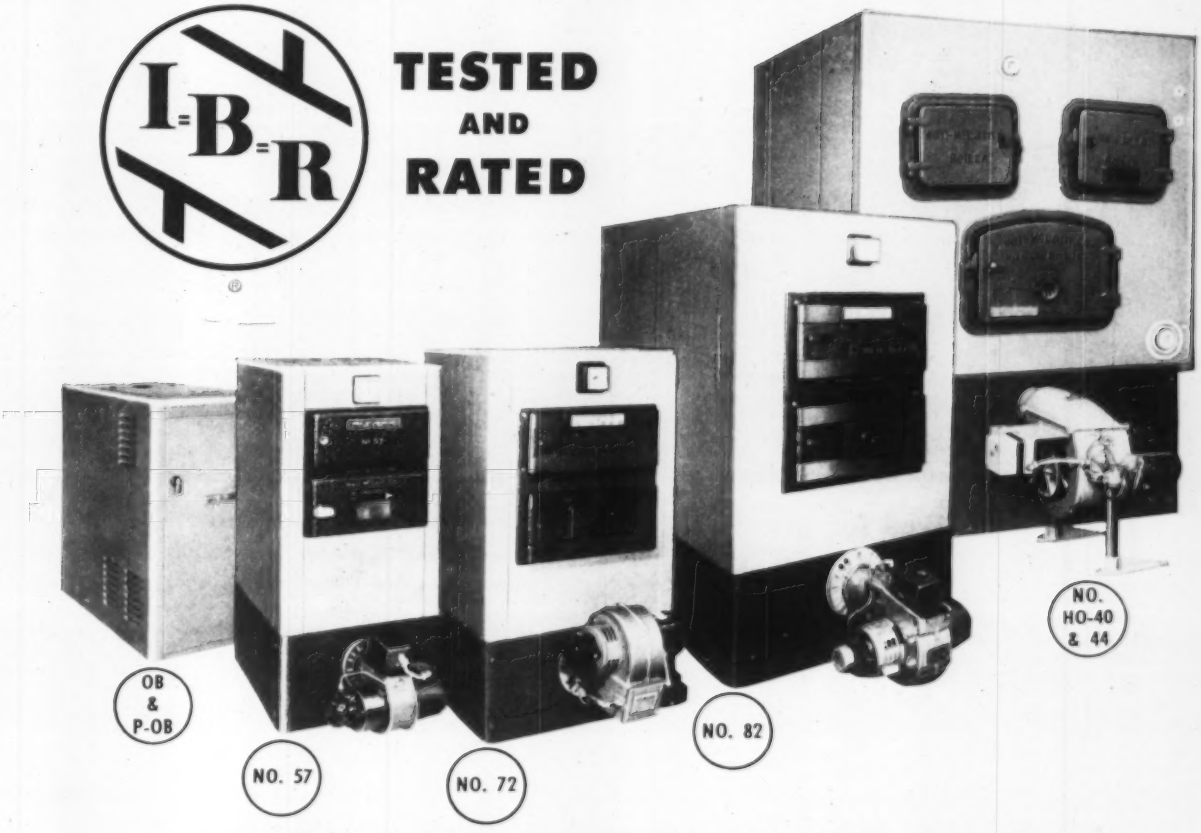
* American-Standard and Standard® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard
AMERICAN BLOWER DIVISION

A complete line of OIL BOILER-BURNER UNITS BY WEIL-McLAIN

MEMBER I=B=R

TESTED AND RATED



PRESENTING NEW AND EXCLUSIVE DESIGNS FOR HIGHER EFFICIENCY...GREATER DEPENDABILITY...AND LONGER LIFE

Weil-McLain now offers a single source of supply for oil heating units in net capacities from 68,000 to 2,709,600 BTU/hr. These are boilers designed specifically for oil-firing, with many exclusive features which assure dependable operation and fuel economy. The burner and other components *are engineered and integrated to function as a unit;* so that the basic requirements of efficient oil-firing are fully satisfied.

All Weil-McLain Oil Boiler-Burner Units are I=B=R tested and rated...your assurance that they will deliver performance as published. These units are also available as oil-fired boilers.

Weil-McLain Boilers are also distinguished by numerous features which contribute to long, trouble-free life.

Built of corrosion-resistant cast iron, assembled with multiple short draw rods and made gas-tight with new asbestos rope seal, they can be rapidly erected in a strain-free assembly.

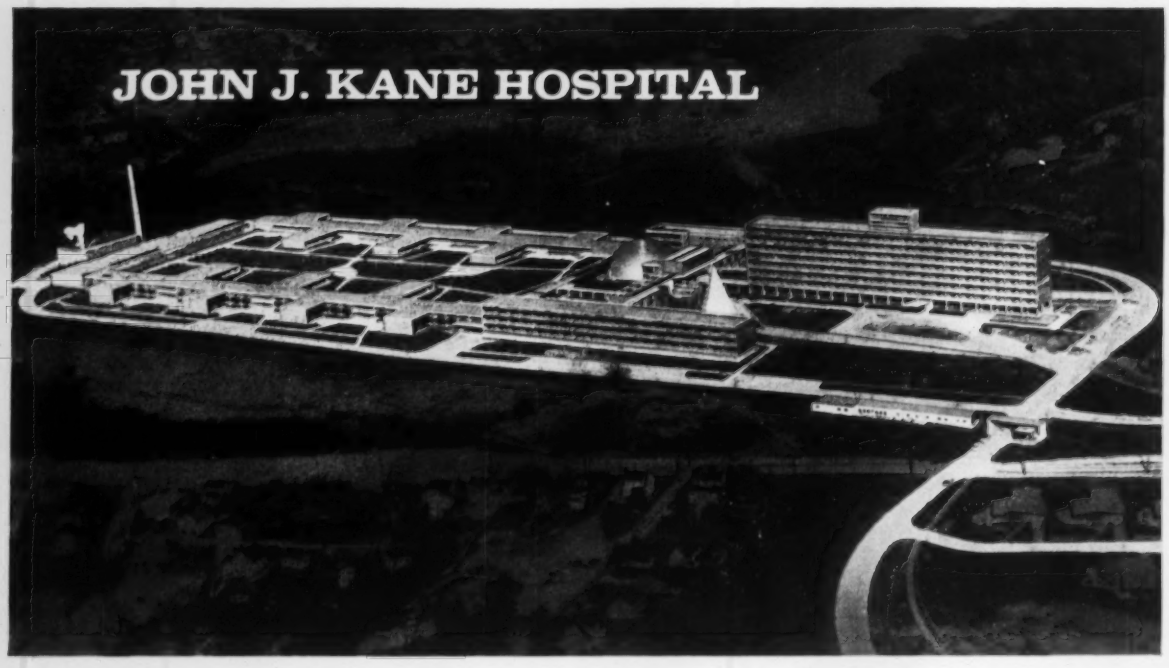
Let us send you these catalogs on Weil-McLain Oil Boiler-Burner Units for residences, commercial and industrial buildings.

WEIL-McLAIN BOILERS · RADIATORS

WEIL-McLAIN COMPANY
MICHIGAN CITY, INDIANA

Address literature requests to Dept. AA-98

In Alleghany County's new 2100-bed



All the valves for plumbing heating and other services are JENKINS VALVES

Architects: Button & McLean — Mitchell & Ritchie

Consulting Engineers: Dzubay, Edwards & Bedsole

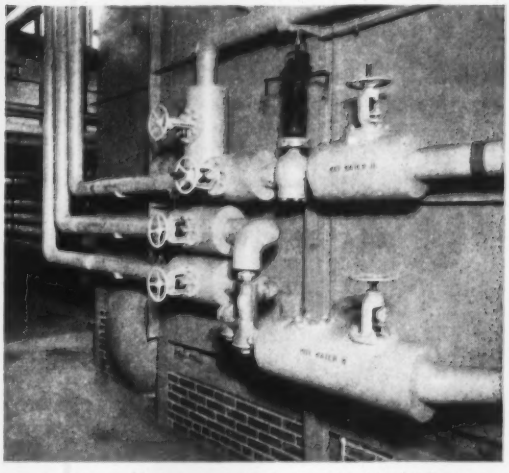
Plumbing, Heating & Air Conditioning Contractor: Sauer, Inc.

Constructed on a 126-acre site eight miles from downtown Pittsburgh, the $22,000,000 John J. Kane Hospital, with its sprawling array of related buildings, is more like a community.

Selection of operating equipment for this vast institution for the care and rehabilitation of the indigent ill was dominated by one specification: maximum value for the taxpayers' dollars.

The specification "JENKINS" for *all* valves for plumbing and heating and other services in the 2100-bed hospital speaks for itself.

No other valves have such a long record of efficient, low-cost service. To building experts and plant operating men, the Jenkins Diamond on a valve has been a mark of extra value for nearly a century. Yet the valves that bear this famous symbol cost no more. Jenkins Bros., 100 Park Avenue, New York 17.



Among the varied types and sizes of Jenkins Valves are these Iron Body Globe and Gate Valves controlling high pressure feedwater.

In the buildings in America's future .....

Sold Through Leading Distributors Everywhere

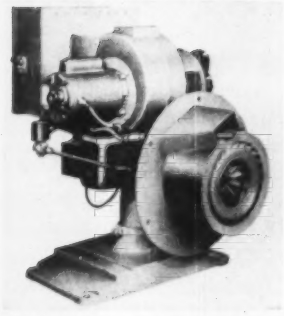
JENKINS VALVES

LOOK FOR THE JENKINS DIAMOND

JENKINS SINCE 1864 Jenkins Bros

EQUIPMENT DEVELOPMENTS . . .

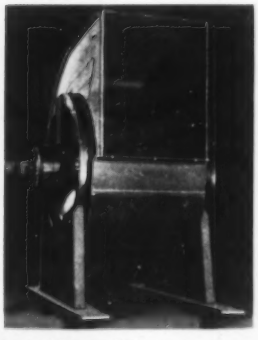
For reviews of Recent Trade Literature see Page 252



Combination Burners . . .

. . . developed for forced-draft firing of gas, light oil, draft fuel in medium size pressurized or natural draft boilers—*Iron Fireman Mfg. Co., Dept. HPAC, 3170 W. 106th St., Cleveland* 11.

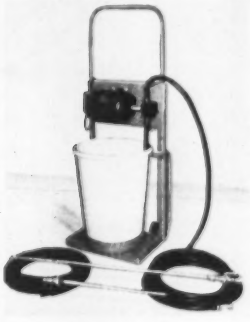
"WhirlBlast" burners include new burner head designed to prevent flame pulsation, eliminate need for high smoke-stack. Models available for flange mounting or pedestal mounting. Capacity ranges: 1,200,000 to 3,600,000 Btu per hr input for gas, 8 through 24 gal per hr of No. 2 or lighter oil. Burner has independent ignition systems for gas, oil.



Centrifugal Fans . . .

. . . in four sizes, designed to cut noise to minimum—*Hg Electric Ventilating Co., Dept. HPAC, 2850 N. Pulaski Rd., Chicago* 41.

"BC" airfoil centrifugal fans available in direct-connected, belted models with capacity ranges to 55,152 cfm. Airfoil design of fans said to greatly reduce eddy currents, turbulence responsible for most fan noise; airfoil blades also less subject to drag, shock losses than fan blades of uniform thickness, says manufacturer. Fans intended for Class I, II, III operations up to 9 in. SP. Spark, corrosion resistant construction.



Coil Cleaner . . .

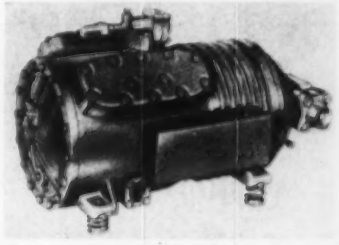
. . . in new 1958 model—*Hastings Air Control, Inc., Dept. HPAC, 3215 Leavenworth St., Omaha* 5.

"Clean-It" has acid proof polyethylene tank and acid proof pump with heat resistant impellers, titanium shaft. Tank is mounted on rubber-tired wheels with belt-lined skids for going up, down stairs. Watercooled condensers, coil tubes are descaled by using unit to recirculate acid solutions; sediment settles to bottom of tank and clean solution is pumped back into tubes. Aircooled and evaporative condensers, coil surfaces, cooling towers, blowers cleaned by using unit to spray hot detergents, solvents through high velocity nozzle; dirty solution syphoned out with oval shaped suction tube.

Packaged Boiler . . .

. . . in high and low pressure designs for steam or hot water service—*Orr & Sembower, Inc., Dept. HPAC, Morgantown Rd., Reading, Pa.*

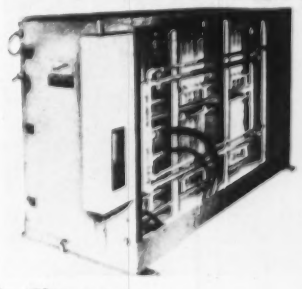
Initial production of boiler covers five sizes: 15 through 50 hp; 502,000 to 1,675,000 Btu per hr. Unit is equipped with mechanical pressure atomizing oil burner or partial premixing gas burners for burning light oil or available gas fuel. Combination burners for oil or gas can be furnished.



Motor Compressors . . .

. . . in units up to 15 hp—*Brunner Co., Div. of Dunham-Bush, Inc., Dept. HPAC, 179 South St., West Hartford* 10, *Conn.*

Units are suction gas cooled for durability in the motor windings. Dynamically, statically balanced for quiet, steady performance. Available for use with refrigerant 22 in models 2 to 15 hp, with refrigerant 12 in models 1½ to 7½ hp.



Air Cleaners . . .

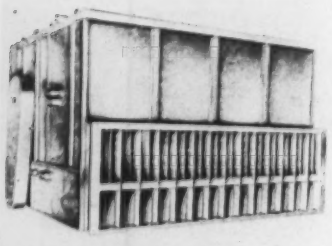
. . . with fully automatic operation—*Westinghouse Sturtevant Div., Dept. HPAC, 200 Readville St., Hyde Park, Boston* 36.

"Model PG" available in range of sizes to handle requirements from 1920 to 28,800 cfm. Washing, adhesive application on air cleaners is completely automatic: motorized traverse washer flushes out collected dirt from metal collector plates, sprays new coating of cold water

EQUIPMENT DEVELOPMENTS

Continued

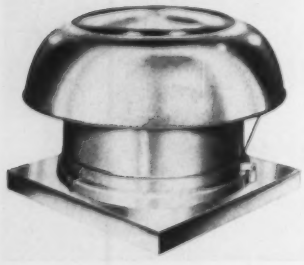
adhesive; sequencing controller performs cycle of stopping fan, completing washing cycle, returning system to normal service. Optional clock control available which operates sequencing controller on predetermined schedule.



Fan-Coil Units . . .

. . . designed for space-saving and flexibility—*Carrier Corp., Dept. HPAC, 300 S. Geddes Ave., Syracuse, N. Y.*

Eight sizes available with air volumes from 2400 cfm. Units reach top capacity of 41,750 cfm of conditioned air with coil face velocity of 700 fpm and no water carryover. For face velocities of 574 fpm, units provide 33,500 cfm. Units use direct expansion or remotely located cooling and heating sources. Selection of cooling, heating coils available with copper tube, copper or aluminum fins.



Power Roof Exhauster . . .

. . . in design developed to combine high air discharge and low contour appearance—*Jenn-Air Products Co., Inc., Dept. HPAC, 1102-08 Stadium Dr., Indianapolis 7.*

Wheel or blade located in top of all aluminum housing of "Type HiD Series HCB" (centrifugal wheel) and "HAB" (axial blade) belt drive exhausters. Other design features cited: enclosed full ball bearing motors; permanently sealed prelubricated ball bearing tubular drive assembly; heavy gage stainless steel bird guards; adjustable motor pulley for sped variation. "HCB Series" available in 46 models with capacity ranges from 1620 to 21,400 cfm; "HAB" series available in 24 models with capacities 4130 to 28,650 cfm.

"Y" Valve . . .

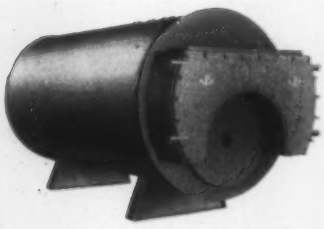
. . . developed to provide low flow resistance of gate or plug valves with convenience, control of globe valve—*Parks-Cramer Co., Dept. HPAC, P. O. Box 444, Fitchburg, Mass.*

"Y" Valve stems are standard with regular thread; quick opening type available. Can be supplied in packless type, bellows sealed between bonnet and disc. Currently available in 2 and 3 in. line sizes with range of sizes from 1¼ to 8 in. planned. Standard material is semi-steel; also available in ductile iron, bronze, steel, stainless steel. Valves are fully jacketed, intended for use with steam, hot oil, other heating media.

Air Filter . . .

. . . of rollaway, disposable media type—*Continental Air Filters, Inc., Dept. HPAC, Box 1647, Louisville 1.*

Of manual type, "Conomanual," is designed for installations where cost limitations prevent consideration of automatic equipment. Viscous impingement media is synthetic fiber blanket backed up with strong cotton mesh in 72 ft rolls and is resistant to moisture, fungus, fire. Operates at 250 to 500 fpm.



Low Pressure Boiler . . .

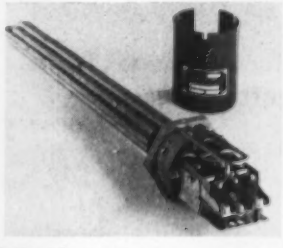
. . . intended for institutions, commercial, industrial applications—*Portmar Boiler Co., Inc., Dept. HPAC, 193 Seventh St., Brooklyn 15, N.Y.*

"WBS" is scotch type boiler made to ASME specifications. Boiler rests on reinforced saddles, directly on boilerroom floor. Features cited: "wet-back" design; gastight smoke box, gasketed rear door for access to tubular and steel combustion surfaces for maintenance, repair; fired with gas or oil for natural, forced draft. Available in 13 sizes with steam ratings from 5170 to 42,500 sq ft. Water capacities range 8750 to 68,000 sq ft with low working pressures of 15 psi steam, 30 psi water.

Power Roof Ventilators . . .

. . . with airflow design for large space ventilating—*Ilg Electric Ventilating Co., Dept. HPAC, 2850 N. Pulaski Rd., Chicago 41.*

Two new additions to company's line have design similar to that of smaller units. Size 423, "Type L-LSQ," has exhaust capacity of 21,000 cfm; size 483, "Type L-SRQ," has 19,600 cfm capacity. Housing completely weatherproofed. Fans used are company's direct-connected, propeller types with low starting torque.



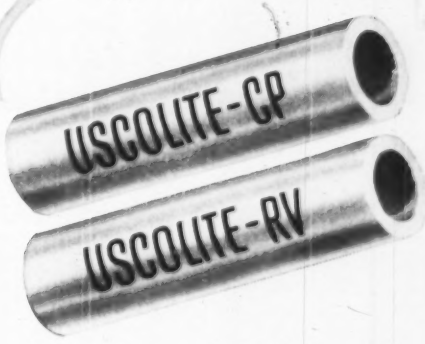
Oil Preheaters . . .

. . . with thermostatic regulation of temperature—*Vulcan Electric Co., Dept. HPAC, 88 Holten St., Danvers,*

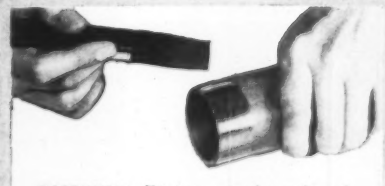
USCOLITE PLASTIC PIPE

PIPE DREAMS come true!

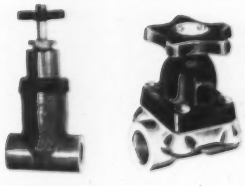
Mr. Usco introduces the complete family of pipe, valves and fittings!



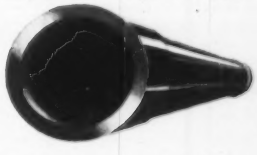
USCOLITE* plastic pipe comes in two specific types, each equally good for its particular purpose. Uscolite CP for high impact resistance, Uscolite RV (PVC) for active oxidizing agents. Not one foot of pipe has had to be replaced in the 10 years since first installed.



USCOWELD* Fittings are the only solvent-weld fittings with an interference fit. Greater joint strength, faster insertion. Non-porous, leak-proof. Made of either Uscolite CP or RV materials.



USCO* VALVES offer a choice of either Hills-McCanna diaphragm valve or Vanton "Flex-Plug" gate valve.



USCOFLOW is a new, black utility pipe, especially suited where low first costs are a factor. It is a blend of styrene-base resin and synthetic rubber for good impact resistance and high tensile strength.

The "Usco" Plastic Pipe Line of precision-molded pipe and fittings for every corrosion and flow problem includes elbows, tees, couplings, flanges, reducing bushings, plugs, caps, nipples, bends.

When you think of plastic, think of your "U.S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality plastic pipe and fittings.

Mechanical Goods Division

United States Rubber

*Patent applied for

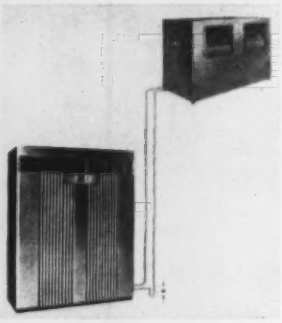
WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

EQUIPMENT DEVELOPMENTS
Continued

Mass.

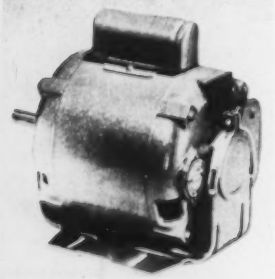
New line includes low density tail piece heaters, suction or return line heaters, circulation heaters in wide range of models, wattage and voltage ratings. Units of 1, 2, 3 and 5 kw available with dual control or single control thermostats. Temperature controlled to ± 5 F. Larger models available to 36 kw, 208 to 550 volts, single or three phase, 3, 5 or 6 in. pipe flanges with or without thermostat.



Air Cooled Condensers . . .

. . . in new line of air cooled, commercial air conditioning units rated to 254,000 Btu per hr gross cooling capacity—*American-Standard, American Blower Div., Dept. HPAC, Detroit* 32.

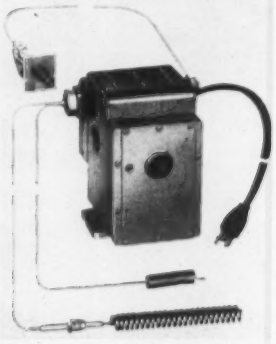
Each base unit rated with condensers of matching size, oversize condensers as well, giving an expansion from 6 to 12 in number of capacities available. The 12 capacities obtained by using 6 base units with selected quantities from 3 available condenser sizes.



Single Phase Motors . . .

. . .for fan drives—*A. O. Smith Corp., Electric Motor Div., Dept. HPAC,* 531 *N. Fourth St., Tipp City, Ohio.*

Intended for air conditioning equipment, ventilation, exhaust fans, models in 115, 230 volt size are available in 1/3 through 1½ hp ratings with 230 volt models available in 2, 3 hp ratings in both 1800, 3600 rpm speeds. All models have terminal boards for ease in connecting line leads on product assembly lines. Units also have dual rotation will all fan duty motors wound for either direction of rotation.



Unit Ventilator Control . . .

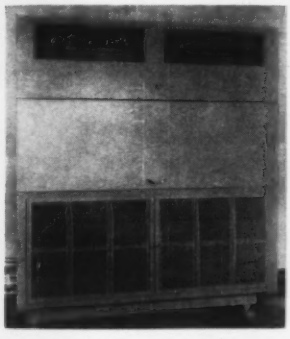
. . .consisting of motor operator for damper control, actuated by self-contained dual temperature sensing elements—*Barber-Colman Co., Dept. HPAC,* 1300 *Rock St., Rockford, Ill.*

"Dual Element Controller" utilizes two fast responding coil type sensing elements: one for room air temperature; the other, an averaging type for discharge air temperature. Controller mounted within the unit ventilator housing. Control package designed for control of face and bypass type classroom unit ventilators when used for hot water and chilled water heating, ventilating, air conditioning applications.

Steam Generator . . .

. . . designed for process or heating loads requiring steam capacities to 400,000 lb per hr—*Babcock & Wilcox Co., HPAC,* 161 *E.* 42*nd St., New York.*

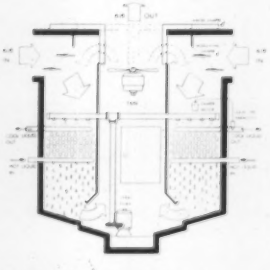
"PFI" boiler available for steam pressures to 1150 lb per sq in. and for superheated steam temperatures to 900 F. Designed to burn oil or gas or combination of two fuels. Unit's "Cyclone Steam Separators" said to separate steam and water so completely that only steam-free water is recirculated. Separators produce maximum circulating heat at all ratings, protecting boiler tubes against overheating, possible burnout.



Aircooled Conditioner . . .

. . .in 15 ton design developed to produce 180,000 Btu per hr—*York Corp., Subsidiary of Borg-Warner Corp., Dept. HPAC, Roosevelt Ave., York, Pa.*

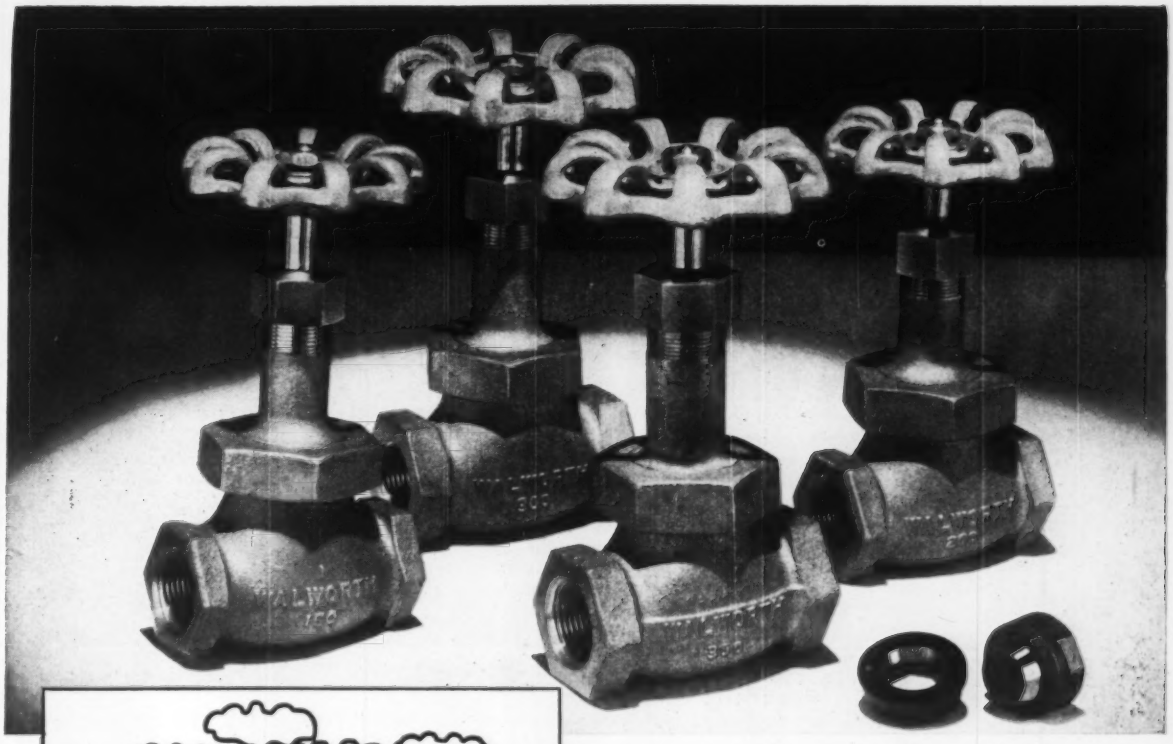
Conditioners intended for cooling of close quarters where high internal loads require cooling even at low outside temperatures. Features cited: cooling down to zero F ambient; twin refrigeration circuits with one evaporator step-controlled or separate twin evaporators, step or independently controlled; evaporators can be mounted horizontally or vertically, with or without heating coils.

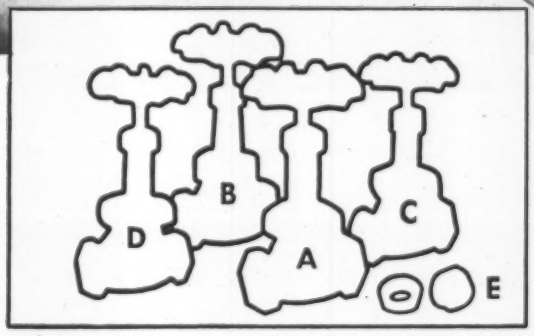


Heat Exchangers . . .

. . .designed to protect operation from freezing in extreme winter climates—*Niagara Blower Co., Dept. HPAC,* 405 *Lexington Ave., New York* 17.

Basic principle of "Sectional Aero" units is cooling of liquid by evaporation of small amount of water on surface of tubes, through which liquid passes. Temperature control said to be maintained within close limits by varying amount of outdoor





A — No. 225P.....350 WSP 550F, 1000 WOG
B — No. 260P.....300 WSP 550F, 600 WOG
C — No. 245P.....200 WSP 550F, 400 WOG
D — No. 237P.....150 WSP 500F, 300 WOG
E — "500 Brinell" Stainless Steel Plug Type Seat and Disc

Walworth offers four lines of Bronze Globe Valves with stainless steel, plug-type seats and discs. Advantages of these valves include:

• **Stainless Steel Plug-Type Seats and Discs,** heat-treated to a minimum of 500 Brinell hardness reduces wire-drawing to a minimum. Seats and Discs are machined and fitted simultaneously, assuring perfect mating.

• **Deep Stuffing Boxes with Glands** are fitted with reinforced, molded packing. Valves can be repacked under pressure when fully opened.

For Longer Bronze Valve Life . . .

"500 BRINELL" PLUG-TYPE STAINLESS STEEL SEATS AND DISCS

150 lb. 200 lb. 300 lb. 350 lb.

• **Oversize Stems,** made of high tensile strength silicon-bronze, assure long life.

• **Rugged Body Hexes,** are flat on top; do not interfere with wrench gripping body-to-bonnet union ring connection.

• **Bodies,** made of Composition M bronze (ASTM B61), have ample wall thickness to provide high safety factor.

• **Patented Handwheels** are air-cooled and designed with a "finger-fit grip." Makes turning easy even when wearing greasy gloves.

• **Identification Plates** secured by lock-washer under stem nut, show Figure Number of valves and make re-ordering sure and easy.

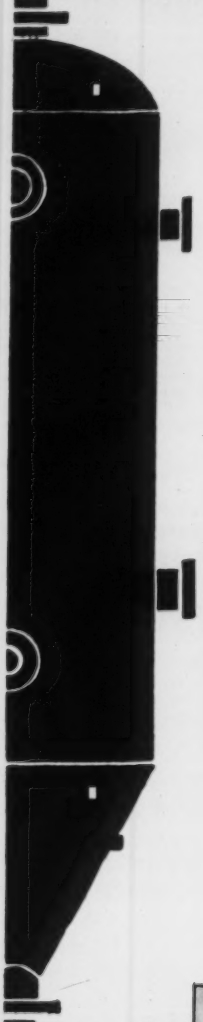
FOR COMPLETE INFORMATION, SEE YOUR WALWORTH DISTRIBUTOR OR WRITE FOR ILLUSTRATED CIRCULAR

WALWORTH

750 Third Avenue, New York 17, New York

SUBSIDIARIES: ALLOY STEEL PRODUCTS CO. · CONOFLOW CORPORATION · M & H VALVE & FITTINGS CO. · SOUTHWEST FABRICATING & WELDING CO., INC. · WALWORTH COMPANY OF CANADA, LTD.

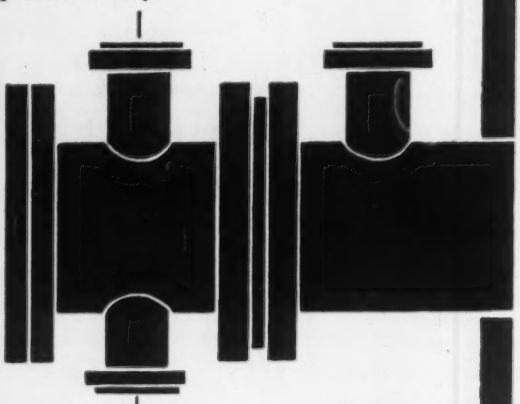
Announcing CORROSION CONTROLLED VESSELS



NOW stop corrosion before it starts in new storage vessels. Specify a Novelon lined vessel from Ellicott to prevent corrosion, rusty water; contaminated contents.

Ellicott has combined its fifty years of building unfired pressure vessels and storage tanks—with ten years of developing a complete line of Novelon Linings of cement, rubber, lead, copper and the new plastic linings that allow much higher heat resistance.

Novelon linings solve the corrosion problems in storing and processing water, acid, food and chemicals. Send us your corrosion problems today.



Specify ELLICOTT
THERE'S NO EQUAL

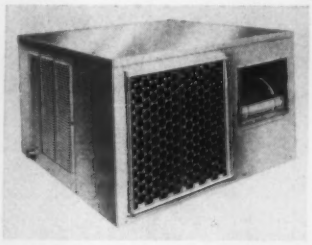
Representatives in Major Cities

Clare and Kloman Streets • Baltimore 30, Maryland

EQUIPMENT DEVELOPMENTS

Continued

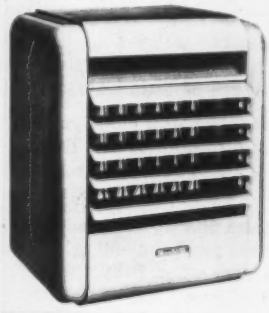
air flow across coils, adjusting capacity to load, removing heat at rate of input. "Winter-Summer" models enclose air modulating dampers in casing, provide for restriction of air supply by manually operated damper in winter climates. Unit water cooling capacities range to 18 million Btu per hr.



Packaged Air Conditioners

. . . for outdoor or semi-outdoor installation—*Mathes Co., Div. of Glen Alden Corp., Dept. HPAC,* 1501 *E. Broadway Ave., Fort Worth, Tex.*

"HAH" horizontal air cooled hermetic packaged air conditioners available in 2, 3, 5 ton models with heat pumps or as models for cooling only. Units are completely weatherproofed and recommended by manufacturer for outdoor installation. Cabinets are 16 gage cold rolled steel finished in baked enamel. Electrical components enclosed in weatherproof box within cabinet.



Unit Heater . . .

. . . redesigned to provide efficient, automatically controlled gas heating at low costs for factory, showrooms, garages, warehouses, other commercial or industrial installations—*John J. Nesbitt, Inc., Dept. HPAC, State Rd. and Rhawn St., Philadelphia* 36.

When the first rocket zooms to the moon, Mr. Readi-Pakt might very well be riding it! That's because our hero makes a habit of getting places. So does Reading Tube's delivery system, which speeds Reading quality products to you through a continent-wide network of distribution depots. Renowned Reading quality in copper and brass tube and pipe is the result of C.Q.C. (Complete Quality Control). It's achieved through step-by-step supervision by specialists in a mill that's wholly integrated — from its own refinery to its own depots. And though Mr. Readi-Pakt doesn't ride personally with every delivery, you always have the assurance of Reading's famous personalized service!

IN TUBING — *Nothing Beats Copper* —
IN COPPER — *Nothing Beats READING!*

READING TUBE CORPORATION

EMPIRE STATE BUILDING NEW YORK 1, N. Y.
WORKS: READING, PA.

Distribution Depots:

READING, PA.
WOODSIDE, L. I., N.Y. 57-17 Northern Blvd.
PHILADELPHIA, PA. 921 Penn St.
ATLANTA, GA. 690 Murphy Ave. S.W., Unit 5, Bldg. B
CHICAGO, ILL. 305 W. 31st St.
CLEVELAND, OHIO 4615 Perkins Ave.
OAKLAND, CALIF. 410 Hegenberger Rd.
LOS ANGELES, CALIF. 120 No. Santa Fe Ave.
DENVER, COLO. 2845 Walnut St.
HOUSTON, TEXAS 1121 Rothwell St.
DALLAS, TEXAS 9000 Sovereign Row Brook Hollow Industrial District

Sold Through Wholesalers Only

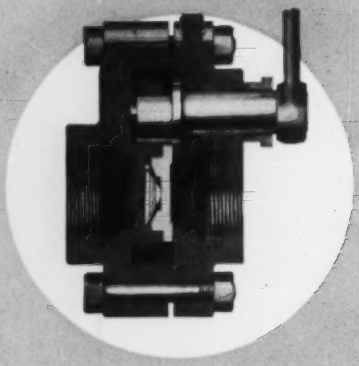
READING COPPER BRASS TUBE

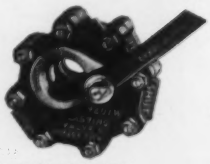
And RED BRASS PIPE

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

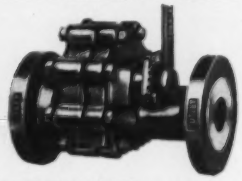
Everlasting Valves

are superior for many services



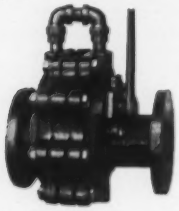


BOILER BLOW-OFF
Quick acting, also handwheel operated "Y" and angle types. For pressures up to 600 psi.



GENERAL SERVICE
Where drop-tight seal and full flow is essential.

CYLINDER OPERATED
Can be remotely controlled, electrically or manually.



STEAM JACKETED
Assures free flow of viscous materials.

WEIGHT-OPERATED
For automatic drains or emergency shut off.

When you want

- quick action
- drop-tight seal
- minimum pressure drop
- straight-through full flow
- self-grinding rotating disc
- valves that cannot wedge or jam

then you want an Everlasting Valve

No other valve has all the Everlasting features . . . proven by half a century of service to assure dependable, leak-tight service.

LET US HELP YOU WITH YOUR VALVE PROBLEMS

EVERLASTING Valves

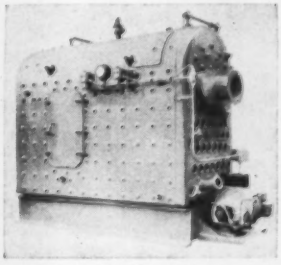
EVERLASTING VALVE CO.
61 FISK STREET, JERSEY CITY 5, N. J.

EV-393

EQUIPMENT DEVELOPMENTS

Continued

"Series K" gas-fired heater lighter in weight in 10 models 25,000 to 250,000 Btu per hr. Controls located at outside rear of unit for access. Motors in all size units directly connected to propeller fan with no internal starting switches. Catalog "No. 400-1" describes new units.



Package Boilers . . .

. . . with forced draft burner designed to eliminate need for elaborate controls, stack or induced draft fan —*International Boiler Works, Dept. HPAC, 918 Plum St., East Stroudsburg, Pa.*

Water tube construction of "Compak" boilers with multi-pass design intended to provide rapid steam or hot water generation, 81 percent thermal efficiency, as guaranteed by manufacturer. Full access possible without dismantling. Sweeping action of hot gases over outer surface of tubes provides self-cleaning feature. Available for low or high pressure hot water or steam generation in capacities to 100 hp. Sizes to 600 hp to be announced.

Leak Detector . . .

. . . developed specifically for air conditioning field—*General Electric Co., Dept. HPAC, Schenectady 5, N. Y.*

"Type H-6" said to be more sensitive, give faster response than other common methods. Sensitivity unaffected by brilliant light or air circulation. Capable of locating leaks within distance of ¼ in., says manufacturer. Unit consists of probe and control unit. Sensing element in control unit has life of approximately 100 hr when used intermittently.

In zero weather this warehouse was heated at a monthly cost of less than a penny per square foot

During last January's sub-zero weather, Dravo *Counterflo* heaters maintained a comfort-heat level of 68° in this 79,000 square foot warehouse—and at a fuel cost of only seven-tenths of a cent per square foot for the month.

Recently erected for C. A. Turner Inc., Rankin, Pa., the insulated industrial supply warehouse, with high roof areas and large access doors for truck and rail shipments, is heated by just three 500,000 Btu/hr and one 750,000 Btu/hr gas-fired heaters.

The Dravo "blanket-of-air" method of circulation is particularly effective in large, hard-to-heat areas. Based on high velocity discharge of warm air above the working zone and low velocity return at floor level, this system reduces heat-loss to the roof. Warm air is pulled down to the work area by the return of cool air to the heater. A Dravo heating engineer will be glad to explain the application of this money-saving principle to your particular heating problem.

Bulletin 564, describing the complete line of Dravo *Counterflo* heaters, is available. Write Dravo Corporation, Dravo Building, Pittsburgh 22, Pa.

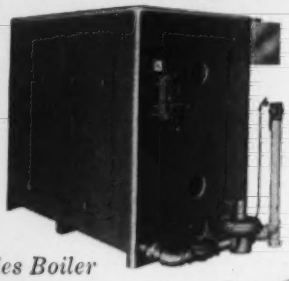
DRAVO
CORPORATION

Blast furnace blowers • boiler and power plants • bridge sub-structures • cab conditioners • docks and unloaders • dredging • fabricated piping foundations • gantry and floating cranes • gas and oil pumping stations • locks and dams • ore and coal bridges • process equipment • pumphouses and intakes • river sand and gravel • sintering plants • slopes, shafts, tunnels • space heaters • steel grating • towboats, barges, river transportation

Specify National-U. S. Heating

ALL THE WAY

Institutional

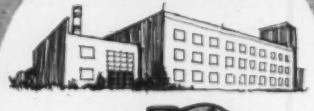


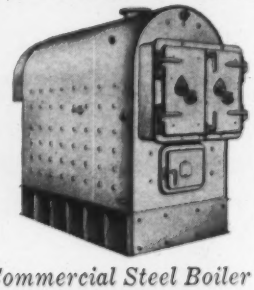
66 Series Boiler

Art Convector

Balanced Products for Better Performance

Industrial





Commercial Steel Boiler

Fintube

Balanced Products for Better Performance

Of course, National-U.S. cast iron or non-ferrous baseboard, convectors, fin-tube and cast iron radiators can be used with *any* good boiler. But they are manufactured primarily to perform at highest efficiency with combination of matched components.

For best performance, specify National-U.S. *all the way*. Our complete, diversified line of balanced products are designed to meet your variable needs. And, the National-U.S. field engineer in your area will be glad to show you how this thinking can be applied specifically to any project you may be working on right now.

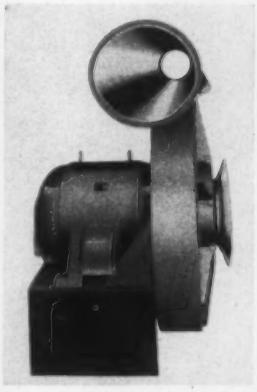
National-U.S. Radiator
CORPORATION
HEATING AND AIR CONDITIONING DIVISION
Johnstown, Pennsylvania
In Canada: 77 York Street, Toronto

58-17

Sixty years in thermal hydronics

EQUIPMENT DEVELOPMENTS

Continued



Materials Handling Fans . .

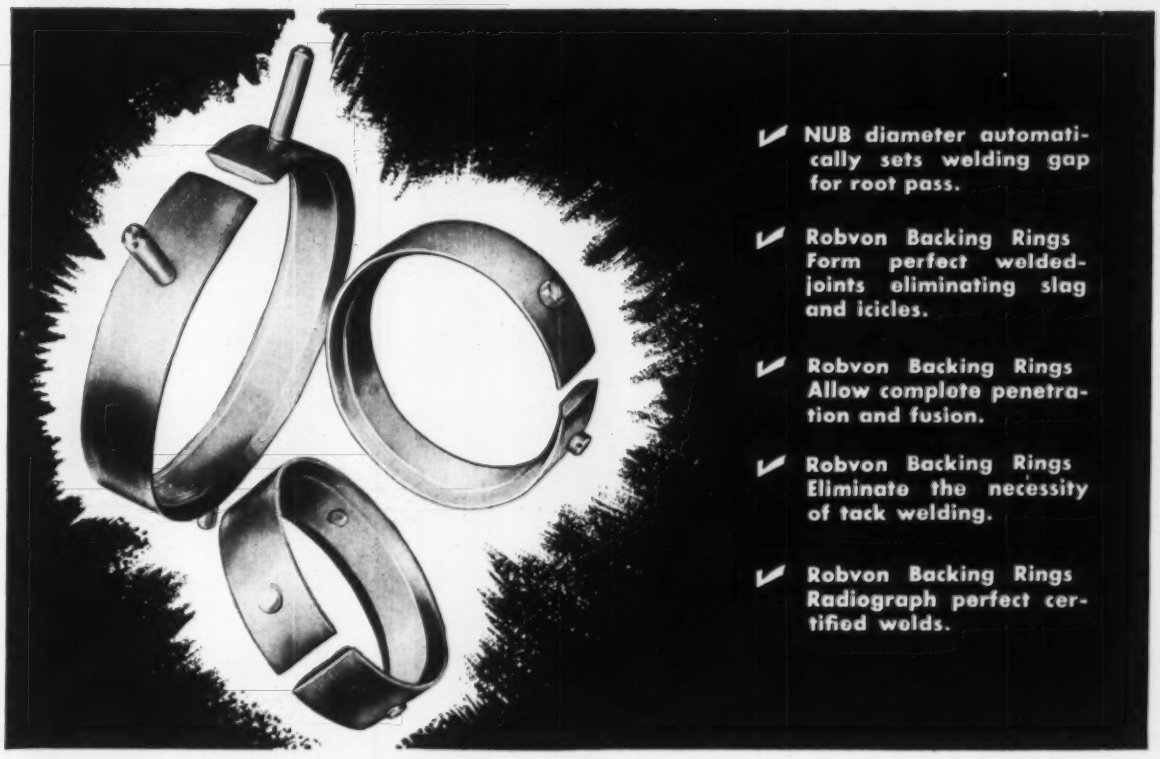
. . . exposing no moving parts to abrasive or corrosive materials handled—*Quickdraft Corp., Dept. HPAC, 1650 W. Tuscarawas St., P. O. Box 87, Canton, Ohio.*

Materials handling units range from 6 to 30 in. diam. All models designed to create high velocities, negative static pressures required to move such materials as cement, sand, wheat, corn, wool, shavings, etc. Negative pressure readings taken 7 diameters back of 77 in. long 8 in. unit exhausting into 13 × 15 × 15 ft storage room were: 17.6 in. water gage, velocity 11,676 fpm pulling 135 ft; 18.6 in. WG velocity 9306 fpm pulling 270 ft; 19.3 in. WG, velocity 6704 fpm; pulling 400 ft. For this application, stainless steel unit was equipped with 60 hp 3450 rpm motor and single-wheel blower.

Water Treatment . . .

. . . developed for more positive protection against scale deposits, faster removal of existing scale, maximum control and economy—*North American Mogul Products Co., Dept. HPAC, 2019 Standard Bldg., Cleveland 13.*

Water treatment formulas intended for use in boilers, water supply systems, air conditioning, refrigeration systems, industrial process cooling water, etc. Active components of formulas combine with metallic ions in solution to form stable soluble combinations that isolate metallic ions. Combinations are



- NUB diameter automatically sets welding gap for root pass.
- Robvon Backing Rings Form perfect welded-joints eliminating slag and icicles.
- Robvon Backing Rings Allow complete penetration and fusion.
- Robvon Backing Rings Eliminate the necessity of tack welding.
- Robvon Backing Rings Radiograph perfect certified welds.

ROBVON BACKING RINGS

APPROVED FOR WELDED PIPE, VALVES, AND FITTING JOINTS

Available in carbon steel, wrought iron, chrome alloys stainless steel, aluminum and copper

TYPE CCC Designed for quick easy alignment of pipe where there is some variation of inside diameters. Chamfered NUBS allow close tolerance fit-up and CLEAN STRIKE OFF. The ROBVON NUB automatically sets the root opening. ROBVON rings are beveled to assure non-restricted fluid flow.

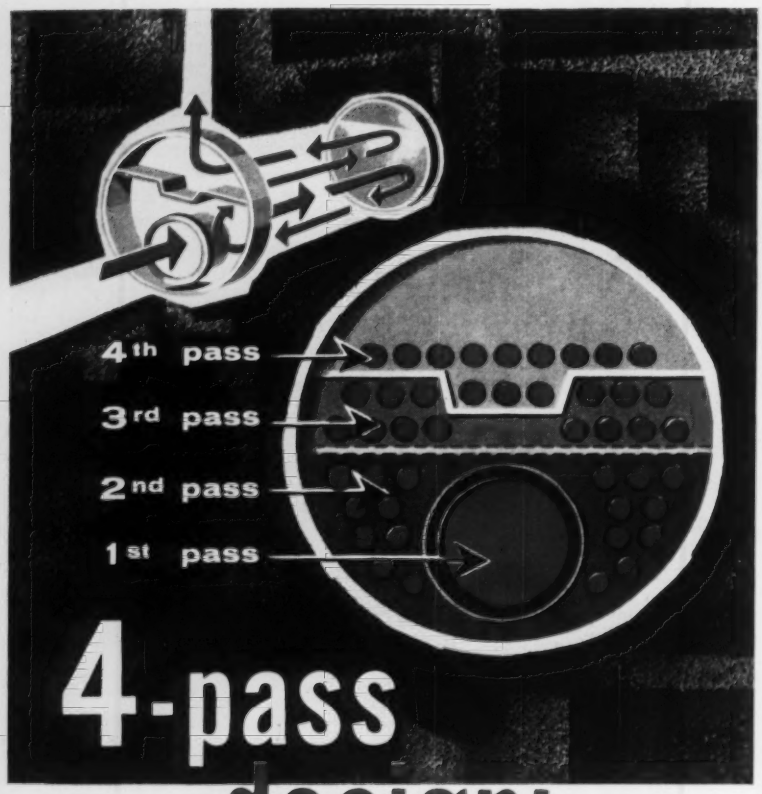
TYPE CC Designed to allow quick easy alignment of pipe where the inside diameters are slightly out of round. The welder has the choice of "STRIKING OFF" the NUBS or leaving them intact to be melted into the weld mass of the first root pass.

TYPE C Designed for precise close tolerance fit-up. Type "C" NUBS conform to the diameter of the weld root. The NUBS melt with the metal to give complete penetration and fusion.

Robvon also manufactures machined rings to customer's specifications
All fabricated solid machined rings x-rayed. Write for full information

ROBVON
BACKING RING COMPANY

675 GARDEN STREET ELIZABETH, NEW JERSEY



4-pass design:

High fuel-to-steam efficiency for greater fuel economy

EVERY CLEAVER-BROOKS boiler has 4-pass fire tube construction — to scrub more heat from the flame. Maintains high flue-gas velocity . . . to provide right conditions for optimum heat transfer. This is just one of the Four Design Standards that make pre-engineered Cleaver-Brooks boilers your best packaged-boiler buy.

Other Design Standards

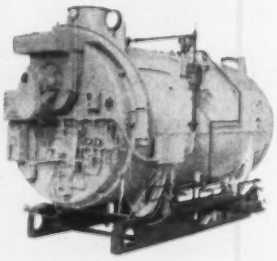
5 SQ. FT. OF HEATING SURFACE per boiler horsepower — prolongs boiler life, assures greater efficiency and lower maintenance.

FORCED DRAFT supplies air for efficient combustion, regardless of draft conditions. Easiest to maintain of all air-control methods.

UPDRAFT CONSTRUCTION — Low furnace keeps hottest combustion gases well below water level for safety's sake.

This exclusive combination of Design Standards is the key to the superiority of Cleaver-Brooks packaged boilers, 15 to 600 hp, 19 sizes, 130 models; steam or hot water; oil, gas or combination oil/gas fired.

For all the facts, call your boiler man from Cleaver-Brooks or write Cleaver-Brooks Company, Dept. K, 313 E. Keefe Ave., Milwaukee 12, Wisconsin.



Cleaver Brooks®

ORIGINATOR AND LARGEST PRODUCER OF PACKAGED BOILERS

EQUIPMENT DEVELOPMENTS

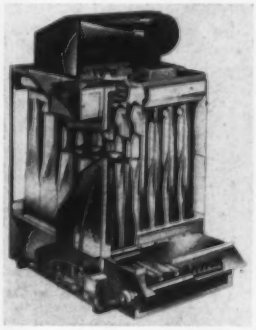
Continued

stable over range of temperatures, pH and concentration. Furnished in highly concentrated liquid form.

Insulation . . .

. . . with wide range of applications —*Pittsburgh Corning Corp., Dept. HPAC, One Gateway Center, Pittsburgh* 22.

"Foamsil" silica insulation available in blocks up to 3 in. thickness and in prefabricated curved segments, wedge-shapes, other designs. May be cut to size in field. Withstands thermal shock within range of −450 to 2200 F.



Duct Heater . . .

. . . fired with either natural, mixed, manufactured or LP gas used for fuel—*Lennox Industries Inc., Industrial Div., Dept. HPAC,* 1701 *E. Euclid, Des Moines, Ia.*

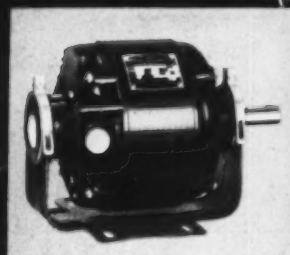
"GSD1" gas duct heater designed for commercial, industrial applications with input capacities from 120,000 to 420,000 Btu per hr. Can be installed in existing ducts to boost heating capacity of existing system; can be added to existing system if separate duct or air supply is available; can be mounted in groups with large single blower and duct to supply air.

Here Knowledge Counts...

In a chess game, it's *knowledge* that pays off. And, when it comes to motors for appliance and equipment manufacturers, Emerson-Electric's team of skilled specialists (more than 100 engineers!) is ready to go to work for you *now* . . . with knowledge that pays off in your profit column.

Remember . . .

- Emerson-Electric produces *custom-engineered* motors to meet *your specific needs.*
- For more than 65 years, Emerson-Electric has been solving problems *like yours.*



Put this special knowledge to work for you! Call, wire or write Dept. M-329 today. The Emerson Electric Mfg. Co., St. Louis 21, Mo.

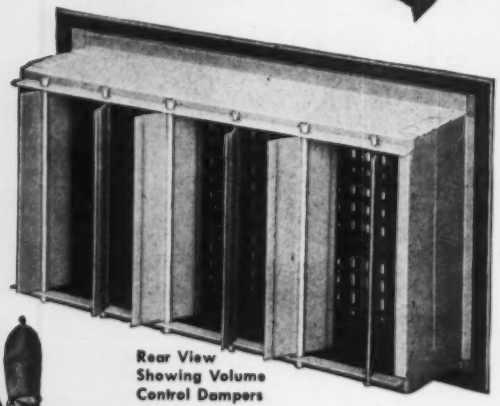
EMERSON-ELECTRIC *of St. Louis · Since 1890*

INDEPENDENT

"Fabrikated"

DOUBLE CORE REGISTERS
with opposed blade dampers
key control
For Commercial Installations

No. 27
Adjustable Vertical Front Bars
Adjustable Horizontal Rear Bars



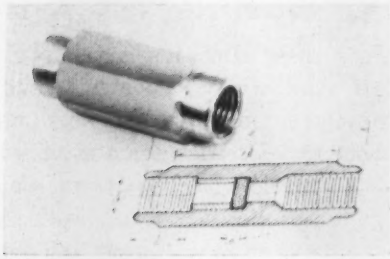
Rear View
Showing Volume
Control Dampers

Write for Catalog
No. 58 which gives
complete details and sizes
up to 48" x 24"

Always leading—
Always Progressing

THE INDEPENDENT
REGISTER CO.
3747 E. 93rd STREET • CLEVELAND, OHIO

EQUIPMENT DEVELOPMENTS — *Continued*



Pressure Snubber . . .

. . . developed for use with oils, water or gases—*Chemiquip Co., Dept. HPAC, 36 E. 10th St., New York 3.*

Pressure snubber incorporates two ¼ in. NPT female pipe connections in design. Fabricated of stainless steel for strength and corrosion resistance, snubber is capable of maximum operating pressure of 20,000 psi. Two female connections eliminate need of coupling or union where pressure instrument and snubber are to be assembled to piping system having male connection provided for pressure instrument. Number of threaded connections is reduced, especially important where noxious or toxic materials are present. Available in ⅛, ¼, ½ in. with male and female pipe connections as well as ¼ in. female and female snubber. Special connections for pressures to 60,000 psi available.

Flange Ratings . . .

. . . with new ratings to broaden service range—*Tube Turns, Div. of Chemetron Corp., Dept. HPAC, 224 E. Broadway, Louisville 1.*

On basis of fatigue, bending tests under simultaneous pressure, flange now recommended for 175 psi liquid, gas or air at 150 F; also rated for 125 psi dry saturated steam at 353 F, which was original rating for water, oil, gas.

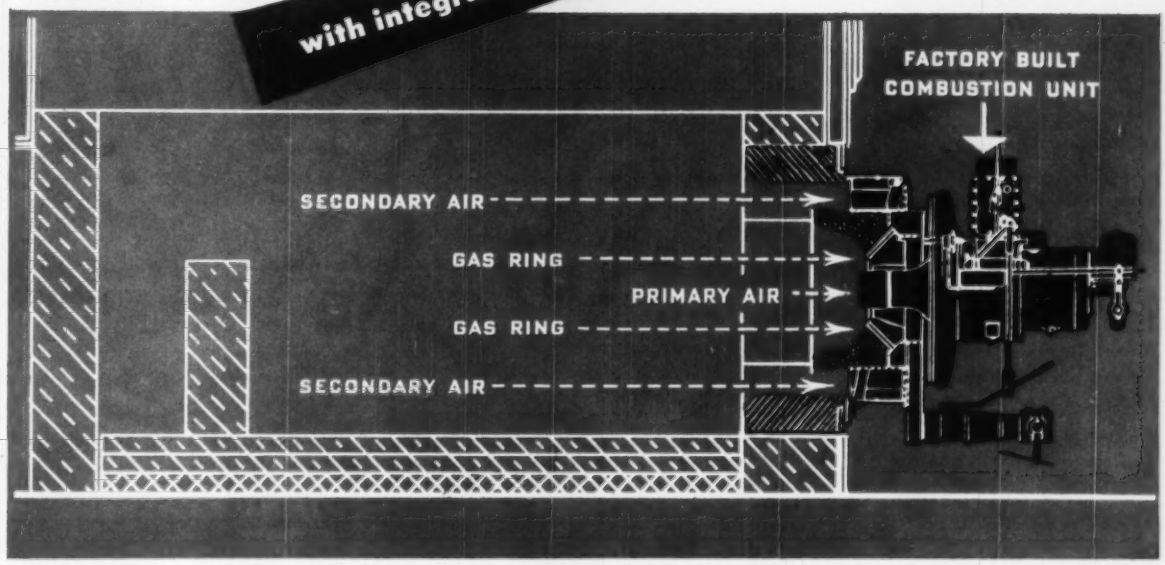
Duct Insulation . . .

. . . of lightweight glass fiber—*Ehret Magnesia Mfg. Co., Dept. HPAC, Valley Forge, Pa.*

"Therma-K" exterior duct and equipment insulation designed for applications where temperatures range sub-zero to 350 F. Vapor barriers of kraft paper, vinyl plastic. Available in rolls 24, 36, 48 in. wide with 2 in. sealing flange along one edge of roll.

PETRO Gas-Oil Burner

with integral air register



Now you can quote lower installation costs on large capacity dual-fuel burners

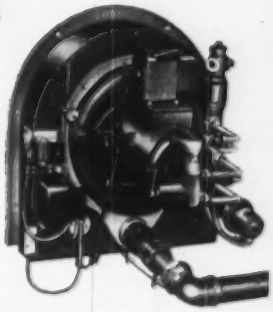
The diagram above tells a story the practiced heating contractor or engineer will grasp instantly—the secondary air register is built into the burner.

The effect of this is also plain—no extensive combustion chamber alteration is needed for the Petro Gas-Oil Burner. It is a complete combustion system ready to bolt to the boiler front. Suitable for all boiler types, including Scotch marine.

Cuts installation costs. The built-in secondary air system eliminates the need for a costly checker floor. Further, the built-in refractory combustion throat requires no additional, locally built, firing arch.

Increased efficiency, too. Secondary air enters through a circular port surrounding the fuel nozzle, assuring a thorough fuel-air mixture with a minimum of excess air. The pre-cast combustion throat is scientifically designed—a critical point in burner efficiency which is frequently mishandled in field-assembled installations.

Contractor and owner both gain. The contractor has an advantage in bidding against competition. The owner benefits from lower first cost, lower maintenance, lower fuel bills.



Petro dual-fuel burner with integral air register simplifies installation, increases combustion efficiency and adds to effective length of firebox.

Send coupon for furthur information on Petro oil and gas firing equipment

PETRO

T.M. REG. U.S. PAT. OFF.

MAKERS OF QUALITY HEATING AND POWER EQUIPMENT SINCE 1903

PETRO
3235 West 106th Street, Cleveland 11, Ohio
(In Canada: 80 Ward Street, Toronto, Ontario)

Please send me literature and specification sheets on money-saving Petro Gas-Oil Burners.

Name .....

Company .....

Address .....

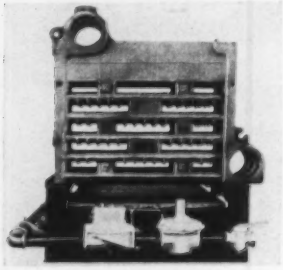
City ..... State .....

EQUIPMENT DEVELOPMENTS
Continued

Piping Insulation . . .

. . . designed to provide insulation for all warm or cold fluid piping—*Rubatex Div., Great American Industries, Inc., Dept. HPAC, Bedford, Va.*

Insulation available in wall thicknesses of 3/16, 1/4, 3/8, 1/2, 3/4 in., with standard diameters from 3/8 to 4 1/8 in. Can be ordered ready to slip directly onto piping or slit lengthwise to be sealed to piping with adhesive. Standard 5 ft lengths available in all ID sizes. Random lengths available up to and including 1 1/8 in. ID. Flexible tubing bends to 180 deg without additional cutting, fitting. Cellular construction renders it lightweight, durable, fire-resistant, impervious to water, moisture, vermin, rot, says manufacturer.



Cast Iron Boiler . . .

. . . in boxed gas passage design that incorporates 13 gas passages per section with 6 horizontal tubular water passages with intermediate risers—*Peerless Heater Co., Dept. HPAC, Div. of Eastern Foundry Co., Dept. HPAC, Boyertown, Pa.*

"150 Series" high capacity, gas fired cast iron boilers have improved water sections with 6 in. ports, tappings. Engineered off-center water tube construction of boiler sections, when assembled, form longer flue travel. 33 sizes available with boilers rated 600,000 to 5,400,000 Btu input per hr for all types gases.

Seal-less Pumps . . .

. . . for commercial and industrial applications requiring circulation of water and abrasive-free liquids—*Fostoria Pressed Steel Corp., Pump Div., Dept. HPAC, Fostoria, Ohio.*

Small size, light weight cited as advantages of "Model 420-D" seal-less

Everybody NEEDS THIS NEW REED CHAIN WRENCH

Ratchet action works either way from either side

IDEAL FOR CLOSE QUARTERS
works where an ordinary pipe wrench won't!

The Reed DU-ALL Chain Wrench does everything a conventional pipe wrench will do, and a great deal more. It gets into tight corners, close to baseboards or between parallel pipe lines, and holds round, square or irregular shapes . . . firmly, without "play" or crushing.

Its fast, ratchet action lets you tighten and "back off" without taking the wrench from the pipe.

All sizes of the DU-ALL wrench have ample chain length for fully tightening pipe up to the diameters handled by ordinary wrenches of equal lengths. Additional chain in the 14" model, however, gives the wrench a full working capacity up to 2" pipe and a holding capacity up to 4 inches. This is a major convenience in lining up soil pipe stacks, straightening studs, setting posts or turning any irregular shape within the leverage range of the 14" handle.

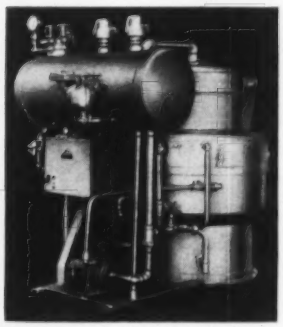
Whenever you want to work with pipe . . . ask for a REED Pipe Tool!

REED MANUFACTURING COMPANY • Erie, Pennsylvania

EQUIPMENT DEVELOPMENTS

Continued

pumps. Pumps have corrosion resistant bronze, stainless steel construction in all wetted metal parts. Circulator has 1 in. threaded intake, discharge connections, handles line pressures to 150 psi, fluid temperatures to 230 F. Motor, pump sealed in one unit, can be installed in any position, replaced, serviced with screwdriver. Magnetic force drives pump impeller. Unit has no starting device, no bearings to lubricate.



Water Tube Boilers . . .

. . . designed for maximum output in minimum space—*Vapor Heating Corp., Dept. HPAC,* 6420 *W. Howard St., Chicago* 31.

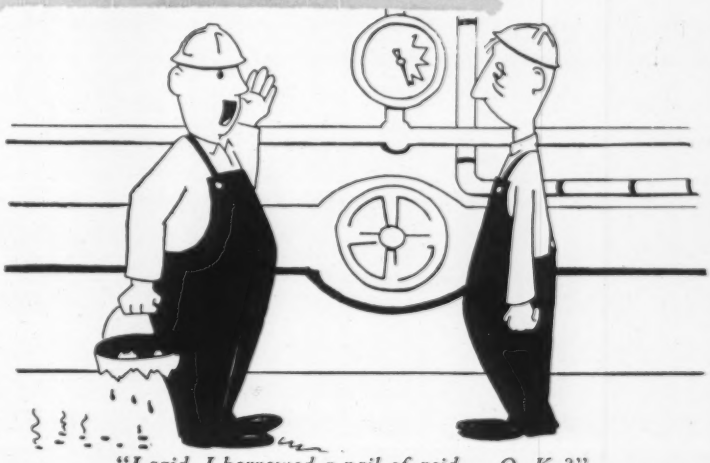
"Vapor Drum Modulatic" boilers require 100 to 175 lb per sq ft support, can be installed on any flooring that will support average man. The 150 hp model shown occupies floor space of 41.3 sq ft, 7 ft 3 in. high. New line available in size range from 20 through 75 hp, 100, 125, 150 hp shown. Can be furnished to deliver low pressure steam at zero to 15 psi, or pressures from 5 to 150 psi. Smaller units burn No. 2 fuel oil or low pressure gas; 100 hp and larger models burn No. 5 fuel oil as well.

Air Conditioning Unit . . .

. . . designed for steam or hot water connections for heating; has self-contained compressor-cooling-coil circuit with aircooled condenser. —*Modine Mfg. Co., Dept. HPAC,* 1500 *De Koven Ave., Racine, Wis.*

Each room individually controlled. Unit has no ductwork, cooling tower drain lines; requires no piping in-

Life in these excited states ...



"I said, I borrowed a pail of acid . . . O. K.?"

ACE-ITE
all-purpose toughie

High-impact, rubber-plastic, most economical for average chemicals. ½ to 6". Screw or solvent welded fittings. Valves ½ to 2". NSF-approved. *Bul. 80A.*

ODD SHAPES?
you make...we line

Rubber or plastic lining is economical life insurance for costly "special" equipment. It's a specialty with ACE. Write for *Bul. CE-53.*

PLASTIC VALVES
for matched systems

Choice of Riviclor PVC, Ace-Ite rubber-plastic, Ace polyethylene or Ace Saran to match *any* plastic pipe. Sizes ½ to 2". Also larger plastic-lined valves.

Time Can't Be Borrowed Either

Equipment running on borrowed time due to corrosion has a knack of dropping the bottom out of production when you can least afford it. No need to risk it . . . just specify Ace chemical resistant equipment. Best for the money anywhere . . . backed by 108 years' experience.

PACHYDERMOUS PAIL

Ace-Hide, tough as a rhinoceros, insensitive to corrosives, makes this finest of acid pails. Also dippers, bottles, funnels, etc.

ACE processing equipment of rubber and plastics

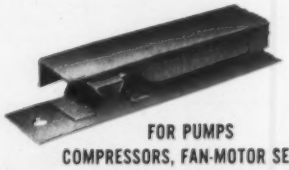
AMERICAN HARD RUBBER COMPANY
DIVISION OF AMERACE CORPORATION
Ace Road • Butler, New Jersey

HOW TO ISOLATE VIBRATION IN AIR CONDITIONING SYSTEMS

Here are eight practical solutions to your vibration problems

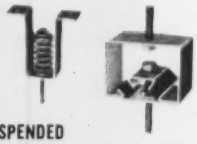
FOR ALL-PURPOSE USE

These rubber-in-shear vibration mountings are widely used for isolating vibration and noise on air conditioning equipment. Shipped complete, ready to use, their rated load is from 40 to 4000 lbs. Catalog RS-55.



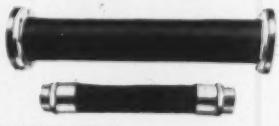
FOR PUMPS COMPRESSORS, FAN-MOTOR SETS

Floating Rail vibration mountings have rubber-in-shear isolators. Rails are tapped and drilled to specification. Bases made for fan-motor sets are shipped complete, ready for installation. Catalog FR-55.



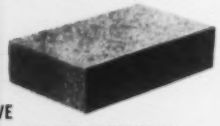
FOR SUSPENDED EQUIPMENT AND PIPING SYSTEMS

Two types of vibration hangers are available: rubber-in-shear (load range: 35 to 1500 lbs.), and steel spring (50 to 1400 lbs.). Both are extremely effective in preventing transmission of vibration from suspended equipment and piping systems. Catalog VH-55.



FOR WATER LINES

The original SOUNDZORBER. Wire-reinforced, wrapped-fabric, rubber pipe widely used for reduction of water line noise and vibration. Working pressures up to 250 psi. Sizes: ½ to 14" ID with I.P.T. male fittings or with full-faced rubber flanges backed up with Series 15 or 30 steel flanges. Catalog SZ-55.



FOR MASSIVE DIFFICULT-TO-ISOLATE EQUIPMENT

ISOLANT is an unusually strong and resilient material which provides excellent isolation of vibration, shock and noise. It is particularly suited for massive air conditioning equipment and similar machinery. Load range: up to 6000 lb. per sq. ft. Catalog IS-55.

FOR HEAVY EQUIPMENT

Steel Spring vibration mountings offer maximum vibration, shock and noise isolation of difficult-to-isolate low-speed machinery, heavy air conditioning equipment, and delicate instruments. Load range: from 100 to 6500 lbs. Catalog SS-55.

FOR FREON LINES

FLEXZORBER, a seamless flexible bronze tubing covered with woven wire braiding, is used to minimize vibration and noise in air conditioning and refrigeration freon lines. Standard copper tube female "slip fittings," welded on both ends, are available from ⅛" to 8" ID. Catalog FZ-55.

FOR STEAM AIR AND GAS LINES

EXPANDZORBER is a stainless steel, welded-diaphragm-type, packless expansion joint used for control of vibration, expansion and contraction in steam, chemical, oil and gas lines. Working pressure from vacuum to 1000 psi at −300 to +1800F. Sizes: ½" to 24" with steel flange or weld end fittings. Catalog EZ-55.

For complete catalog information, write—

FINN

T. R. Finn & Company, Inc., Industrial Division
200 Central Avenue, Hawthorne, New Jersey

VIBRATION FINNFLEX CONTROL

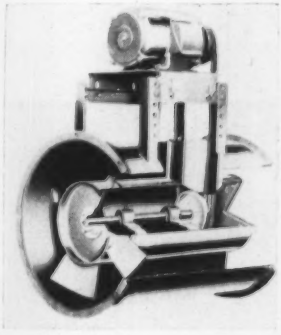
Industry's most complete line of shock and vibration controls

REPRESENTATIVES wanted. If interested write or call, describing qualifications.

EQUIPMENT DEVELOPMENTS

Continued

sulation. Measures 38 in. long, 18⅜ in. deep and 22½ in. high with room enclosure 7 in. deep which may be recessed as much as 3⅛ in. Rated at 8700 Btu per hr cooling capacity, 15,000 Btu per hr for heating on 2 psi steam or 13,100 Btu per hr on 180 F hot water.



Tubeaxial Fans . . .

. . . for mounting directly in ducts, stacks for exhaust or supply air applications—*Westinghouse Sturtevant Div., Dept. HPAC, 200 Readville St., Hyde Park, Boston 36.*

"Series 300" motorized axial flow fans available in seven sizes for ducts, stacks 18 to 42 in. ID, ratings from 2410 to 36,700 cfm. Separate fan, motor platforms eliminated on standard motorized units; anchored shaft design permits universal mounting in horizontal, vertical stacks, ducts. Fans are of heavy gage, steel-welded construction.

Panel Control Centers . . .

. . . produced to specification for power, heat, process applications—*Cleveland Controls, Inc., Dept. HPAC, 1111 Brookpark Rd., Cleveland 9.*

Integrated controls assembled on removable plate in panel control center; instruments mounted on removable face plates. Available in two sizes: 36 in. wide × 84 in. high; 48 in. wide × 84 in. high. Where number or size of controls require, two or more panel control centers can be assembled into single unit. Made of heavy gage steel finished in baked enamel.

Alone or in combination these factors purchase-control every job
CONSULTING ENGINEERS
MECHANICAL CONTRACTORS
ENGINEERS in INDUSTRIAL PLANTS
ENGINEERS in LARGE BUILDINGS

Get through to each

to sell any product used in heating, piping, and air conditioning

Besides their undisputed control of purchasing in this field, what do these KEY factors have in common?

Collectively they are the reader-audience of Heating, Piping & Air Conditioning . . . and no other publication gets through to them like HP&AC. The fact that every copy is *paid for* gives the proof.

But the largest and only fully paid (ABC) circulation in the field isn't the only point in HP&AC's favor. It also leads its nearest rival by over 2 to 1 in advertising volume, carries more editorial pages by far, has more advertisers, and is used on an exclusive basis by more advertisers.

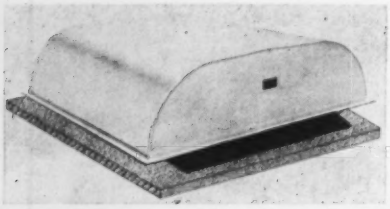
Conclusion: If you want truly ACTIVE and RESPONSIBLE help in getting through to your prospects, concentrate your advertising in HP&AC. It will meet *face-to-face* the engineers and contractors indicated above PLUS the field's important wholesalers and the original equipment manufacturers who are large-scale buyers of accessory products required in factory-built assemblies.

Heating, Piping & Air Conditioning

Air Conditioning Headquarters

KEENEY PUBLISHING CO., 6 N. MICHIGAN AVE., CHICAGO 2

EQUIPMENT DEVELOPMENTS *Continued*



Roof Exhauster . . .

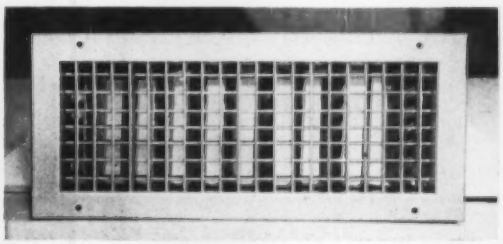
. . . in choice of standard construction with low silhouette housings—*Penn Ventilator Co., Inc., Dept. HPAC, 3252 Goodman Ave., Philadelphia 40.*

"Type LC Dynafan" can be used for quieter operation, longer bearing, belt life, better balance according to manufacturer, because wheel straddles both bearings.

Piping Aligner . . .

. . . designed to provide socket type joint—*Horace T. Potts Co., Dept. HPAC, 504 Erie Ave., Philadelphia 34*

Stainless steel connector holds pipe, fittings in position until welding or brazing secures connection; said to make possible preassembly of complicated process piping layouts. Connector designed specifically to be used with company's fittings, lightwall piping systems, "Schedule 5" and "Schedule 10." Fits over fittings as well as pipe.



Registers and Grilles . . .

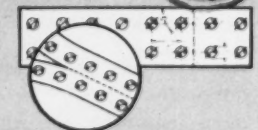
. . . for air conditioning applications—*Universal Diffuser Corp., Dept. HPAC, 38 Marbledale Rd., Tuckahoe, N. Y.*

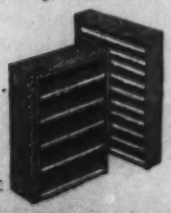
Grille faces made of 18 gage steel with rolled, formed, streamflow blades. New opposed blade damper has overlapping blades designed to prevent air leakage when shut. All guides and holes made to fine tolerances, says manufacturer.

Another CAIN'S COIL OF PROFIT

LOUVERAIL

ELIMINATES
Layout—Tab Cutting, Hole Punching, Riveting, Spot Welding, Etc..





Split (½) Rail for Louver thicknesses from 1¼ to 1¾". Use Full Size Rail for Louver thickness from 3¼" to 4".

Try this economical and practical method for fabricating Louvers — removable, hinged, or stationary. Louverail is 24 ga. galv. 4½" wide in (2—80' lengths) 1 right and 1 left coiled together. Hundreds of variations possible.

Union Made

SOLD ONLY THROUGH JOBBERS AND DISTRIBUTORS
Some Territories Open for Manufacturers Agents Calling on Jobbers and Distributors
CAIN MANUFACTURING CO.
1111 North 5th Avenue Phone FA 7-0354 Birmingham, Alabama

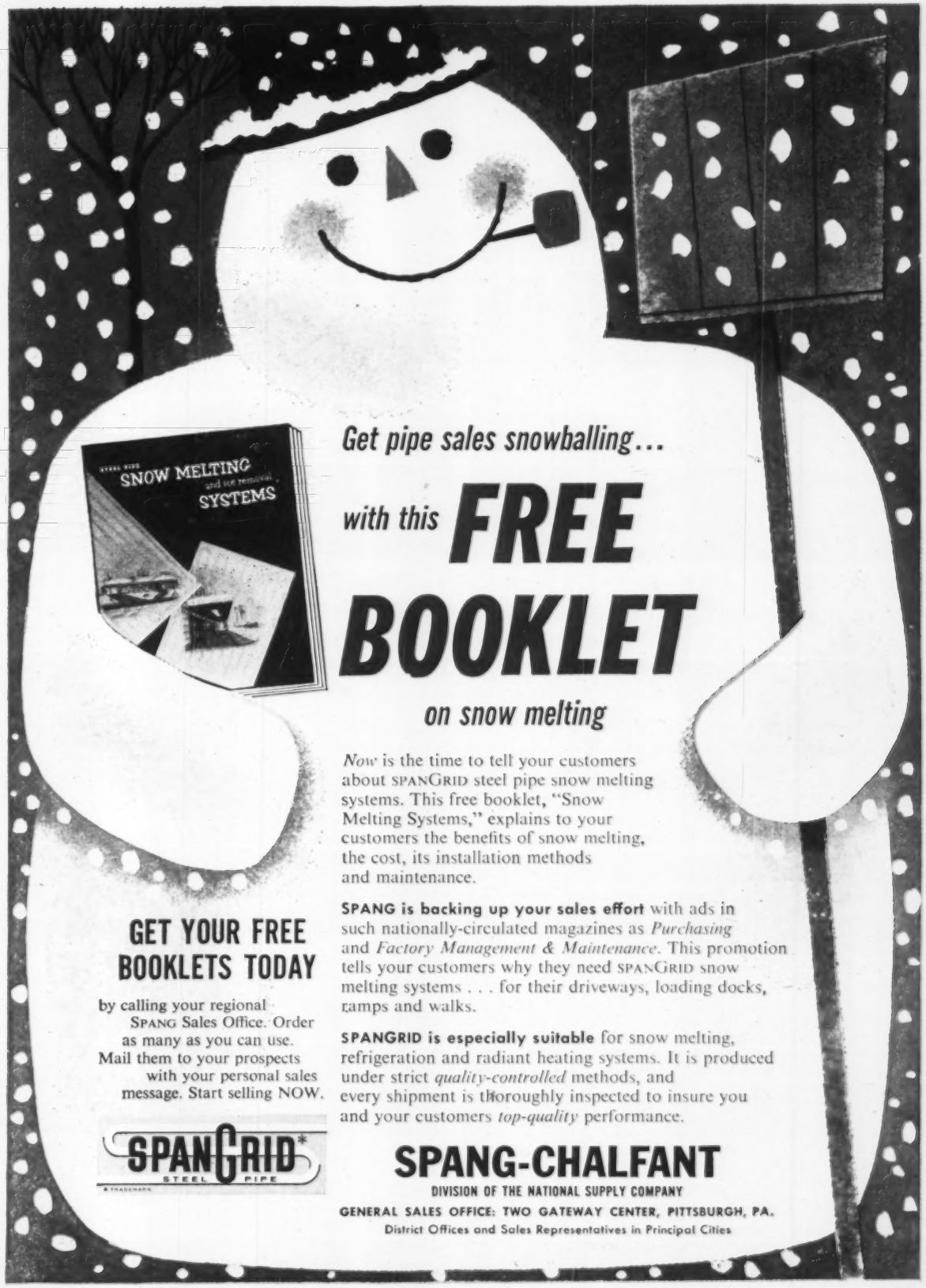
Permanently End Condensation Drip, Rust and Corrosion with NoDrip Plastic Coating!

Here is the inexpensive, easy way to solve your condensation problem once and for all. NoDrip plastic coating acts immediately to insulate and protect tanks, pipes, walls, ceilings, air ducts and other metal equipment against condensation drip, rust and corrosion. NoDrip can be applied by anyone without special experience with brush, trowel or spray. NoDrip is also resistant to acid, alkali and brine... protects concrete, brick, plaster, tile, wood or composition surfaces.

FREE

32-PAGE NoDrip DATA HANDBOOK — Complete with photographs, charts and technical information to help solve your condensation problem. Write today!

Available at leading plumbing and mill supply houses
J. W. MORTELL COMPANY, 568 Burch St., Kankakee, Ill.



Get pipe sales snowballing...

with this **FREE BOOKLET**

on snow melting

Now is the time to tell your customers about SPANGRID steel pipe snow melting systems. This free booklet, "Snow Melting Systems," explains to your customers the benefits of snow melting, the cost, its installation methods and maintenance.

SPANG is backing up your sales effort with ads in such nationally-circulated magazines as *Purchasing* and *Factory Management & Maintenance*. This promotion tells your customers why they need SPANGRID snow melting systems . . . for their driveways, loading docks, ramps and walks.

SPANGRID is especially suitable for snow melting, refrigeration and radiant heating systems. It is produced under strict *quality-controlled* methods, and every shipment is thoroughly inspected to insure you and your customers *top-quality* performance.

GET YOUR FREE BOOKLETS TODAY

by calling your regional SPANG Sales Office. Order as many as you can use. Mail them to your prospects with your personal sales message. Start selling NOW.

SPANGRID* STEEL PIPE

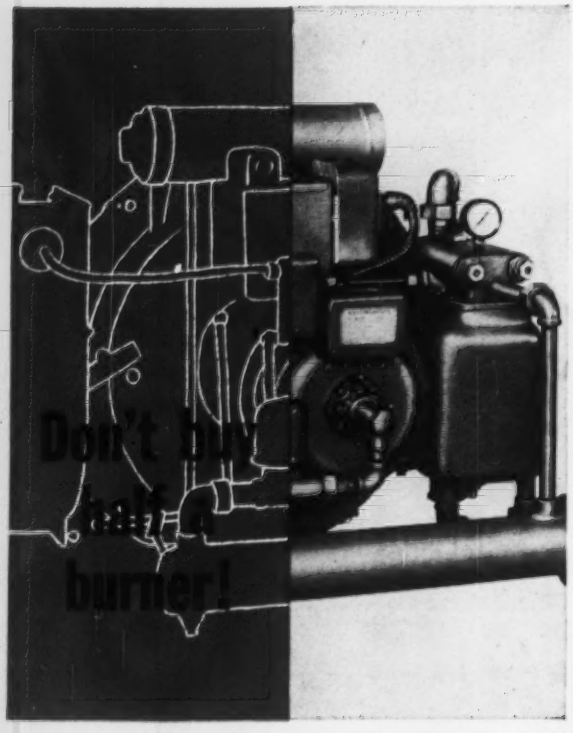
*TRADEMARKS

SPANG-CHALFANT

DIVISION OF THE NATIONAL SUPPLY COMPANY

GENERAL SALES OFFICE: TWO GATEWAY CENTER, PITTSBURGH, PA.

District Offices and Sales Representatives in Principal Cities



A shut down caused by lack of available service for your installation costs you plenty!

Yes, the loss of time and money in any burner shutdown can hurt you badly.

That's why there are *two* factors of prime importance in any commercial burner installation—a quality burner *and* readily accessible service. Only Ray—and the worldwide Ray dealer organization—gives you both.

No matter where you are, a Ray dealer is as close as your phone; there's no need to worry about prolonged shutdowns and consequent losses of time and money.

Ray dealers are highly skilled experts in all types of installations. For added insurance, the services of our own trained Ray engineers are also available to help you solve your particular problem.

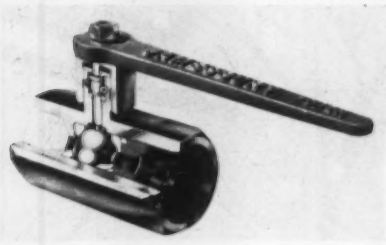
When you buy a Ray you have the finest burner and the most comprehensive service—to provide you with a more efficient, trouble free, operation.

RAY OIL BURNER CO.

DISTRIBUTORS IN ALL PRINCIPAL CITIES OF THE WORLD

EQUIPMENT DEVELOPMENTS

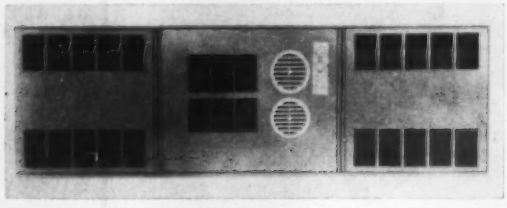
Continued



Ball Valves . . .

. . . intended for use on hydraulic equipment, systems using compressed gases—*Jamesbury Corp., Dept. HPAC, 48 New St., Worcester 5, Mass.*

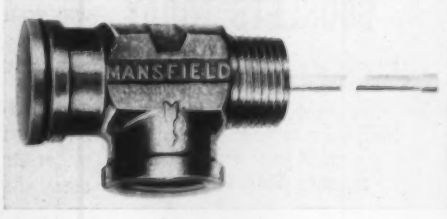
"Style H Double Seal" ball valves produced in ¼ to 1½ in. sizes for straight tubing thread style and ½ to 2 in. for standard pipe thread style. Available with carbon steel, 303 and 316 stainless steel bodies and nylon or plastic seats and seals.



Heating-Cooling Units . . .

. . . consisting of twin convectors for heating with cooling unit in center—*Embassy Steel Products, Inc., Dept. HPAC, 890 Stanley Ave., Brooklyn 8.*

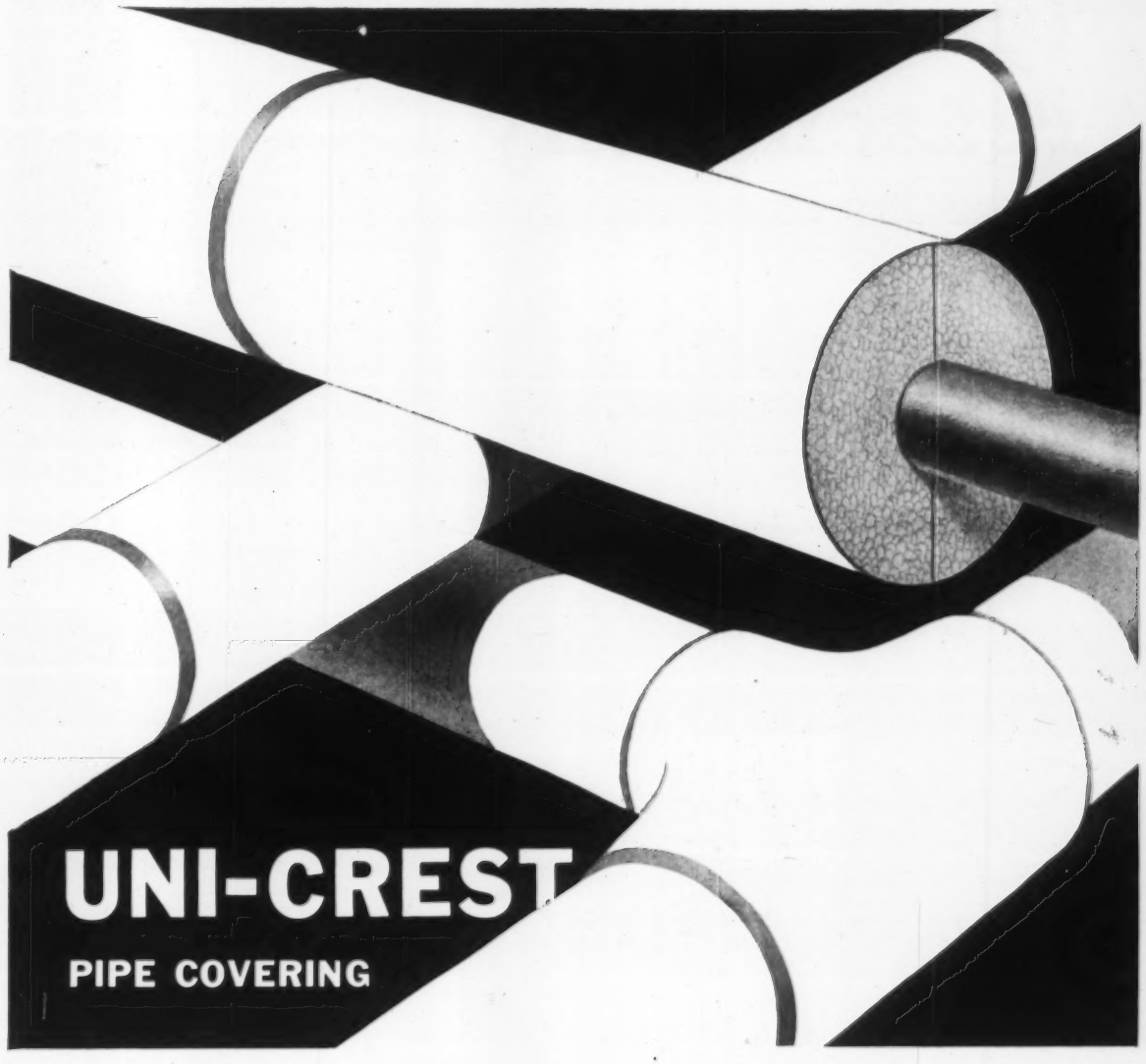
New model of "Weather-Twins Model WT-CAC" consists of self-contained Kelvinator air conditioning unit housed with manufacturer's natural convection heating housed in integal cabinet. Unit has adjustable thermostat, dial controls, two air directional louvers which can be rotated 360 deg. Units available with capacities from 7400 to 13,300 Btu per hr at 115 volts. Available with either copper or steel elements.



Relief Valve . . .

. . . developed for protecting hot water lines against excessive pressures or temperatures—*Mansfield Sanitary, Inc., Dept. HPAC, Perrysville, Ohio.*

"Model No. 494" relief valve is equipped with fusible plug at end of 6 in. extension tube. Tube immerses plug in tank's hottest water offers immediate



a new, economical, low temperature insulation

Uni-Crest, pipe covering, is an excellent low temperature insulating material, and is inexpensive to install and maintain.

Uni-Crest's low thermal conductivity (K factor), plus its high resistance to water and water vapor—are some of its prime qualities. It will not rot, mildew, or support fungus growth.

Extremely lightweight, with a smooth, tough white surface, Uni-Crest is non-dusting, non-flaking, and easily cut and handled on the job. And Uni-Crest is inexpensive, too.

For the address of the office nearest you, plus additional information about Uni-Crest pipe covering and an actual sample, please write to the address below.

UNI-CREST DIVISION UNITED CORK COMPANIES
Since 1907

UNITED UNI-CREST

1Central Avenue, Kearny, New Jersey

Uni-Crest engineering offices or approved distributors are located in key cities coast to coast.

Five important reasons why

Power Line

best solves your industrial ventilation problems:

1. Complete line: Broadest product line of air-moving equipment for every industrial requirement.

2. Certified performance: All Power Line Fans are rated by PFMA and by NAFM.

3. Backed by 33 years of specialization in manufacture of highest quality ventilation equipment.

4. Competitively priced to give you important cost savings in initial investment and in maintenance. You get the precisely right product to fit your requirements. You don't over-buy with equipment too large or under-buy with equipment too small.

5. Sold only through qualified ventilation specialists. You get expert technical advice and service from the survey of your requirements right through to the completion of your installation.

YOURS ON REQUEST: Big 20-page Power Line Catalog gives complete facts about industrial ventilation, including selection of proper type and size of fan, calculation of duct resistance, and installation procedures, plus features, dimensions, specifications and performance data. Without obligation write for your free copy of Catalog No. 38B.

POWER LINE FAN COMPANY, INC.

Subsidiary of Chelsea Products, Incorporated 639 South Avenue, Plainfield, New Jersey

EQUIPMENT DEVELOPMENTS

Continued

relief as soon as temperature exceeds 210 F. Plug, as well as bibb washer, can be replaced without removing valve from line. With red brass body, valve contains stainless steel control spring set to relieve water from tank when pressure exceeds relief setting. Settings adjustable from 50 to 200 psi. Btu rating is 150,000. Inlets and outlets are ½ in.

Pressure Control . . .

. . . for use with air, gas liquid pressures where it is necessary to lower difference between two separate pressures or vacuums—*United Electric Controls Co., Dept. HPAC, 79 School St., Watertown, Mass.*

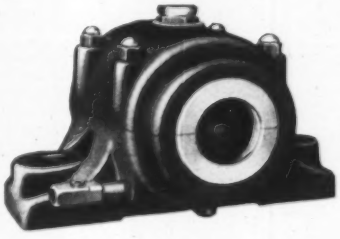
"Type J99K" is explosionproof pressure control designed for hazardous locations where explosive gases, vapors are present. Control is uncalibrated; pressure settings made by removing cover, setting hexhead adjustment screw. "J99K" has cast iron base, aluminum cover; approximate weight, 5 lb. Switches rated for 15, 20 amps at 115/230 volts, a-c; single pole, suitable for ambient temperatures to 180 F.

Pipe Fitting Packaging . . .

. . . developed to provide protection for valuable stainless steel and nonferrous welding fittings—*Tube Turns, Div. of Chemetron Corp., Dept. HPAC, 224 E. Broadway, Louisville 1.*

Sleeve-type cardboard cylinder, like those built to government specifications for packing artillery shells, is designed to prevent damage inflicted in transit or in storage. Fittings, flanges of 25 different metals, alloys included in packaging program.

Bright Lights–That Never Fail



SLEEVOIL BEARINGS

Dodge Sleevoil Bearings are available in plain type or water-cooled. They are self-aligning. Can be drilled for thermostatic emergency warning if desired. Shaft sizes from 1-7/16" to 10".

The brilliant lights of Broadway match the stars in the certainty of their rising. A black-out from power failure is almost unthinkable.

One factor that contributes to the dependability of this steady power supply is the bearing that insures unfailing operation of mechanized draft in the generating plant.

These Bearings are Dodge Sleevoil.

Generating plants throughout America—including those in such metropolitan centers as New York, Detroit, San Francisco, Los Angeles—use these super-quality bearings.

The Sleevoil Bearing is a Dodge development, created especially to meet the exacting requirements of fan and blower service. You are invited to write us for our new Engineering Catalog D56, which contains detailed description, sizes, dimensions.

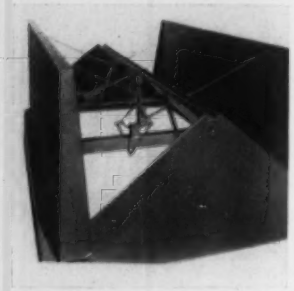
DODGE MANUFACTURING CORP., 1600 Union St., Mishawaka, Indiana

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look in the *white* pages of your telephone directory for "Dodge Transmissioneer."

DODGE
of Mishawaka, Ind.

EQUIPMENT DEVELOPMENTS

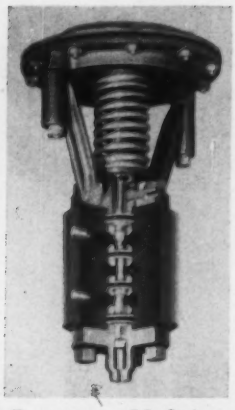
Continued



Relief Unit . . .

. . . redesigned for improved operational characteristics—*Swartwout Co., Dept. HPAC,* 18511 *Euclid Ave., Cleveland* 12.

"Pyrojector" unit changed from curved to flat dampers. Torsion springs added for positive opening action under loads when fusible link in triggering mechanism reaches 212 F. Explosive force of 10 lb per sq ft will open dampers, provide 28 sq ft of escape area. Opens automatically to release heat, smoke, explosive blasts upward through roof.



High-Pressure Valves . . .

. . . with new internal sleeve type construction designed to provide shockless performance, leakfree shutoff with minimum maintenance—*Sinclair-Collins Valve Co., Dept. HPAC,* 454 *Morgan Ave., Akron* 11, *Ohio.*

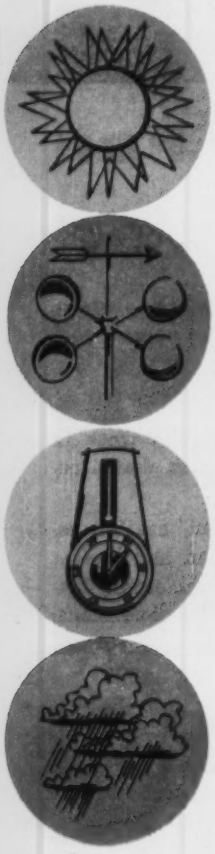
In new design, valve seats are integral in replaceable hardened stainless steel sleeve. Commercial standard O-rings in molded plastic backups provide flexible seal between sleeve and valve body. Leakless shutoff assured, according to manufacturer. Valves available for 4000 and 6000 psi service, sizes to 3 in. NPT for 4000 psi and up to 2 in. NPT for 6000 psi. Offered in two or three way, NO or NC.

Motor Operators . . .

. . . for dampers, valves in heating, ventilating, air conditioning systems —*Barber-Colman Co., Dept. HPAC,* 1300 *Rock St., Rockford, Ill.*

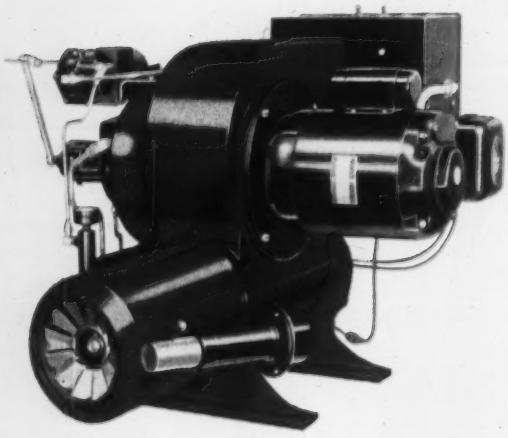
Motor operator is heavy duty re-

(*Continued on page* 235)



FOR HEATING AT ITS BEST WHEN WEATHER DOES ITS WORST —

HEV-E-OIL BURNERS



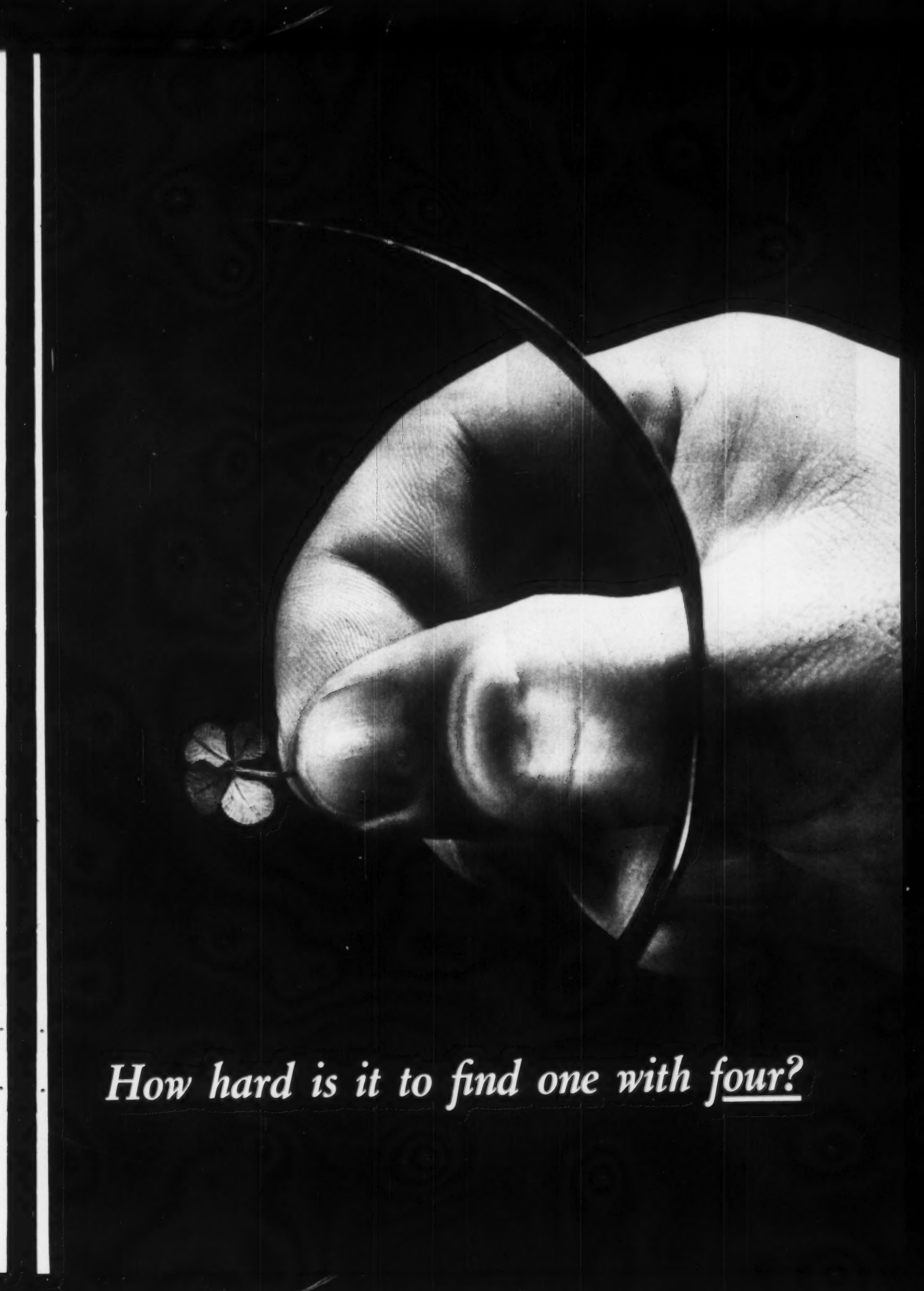
Hev-E-Oil burners furnish all the air necessary for combustion, assuring perfect fire control under all weather conditions. Low fire start that builds up gradually to the flame size required means smooth, safe operation. And once the burner is set for greatest efficiency, it *stays* that way no matter what the weather.

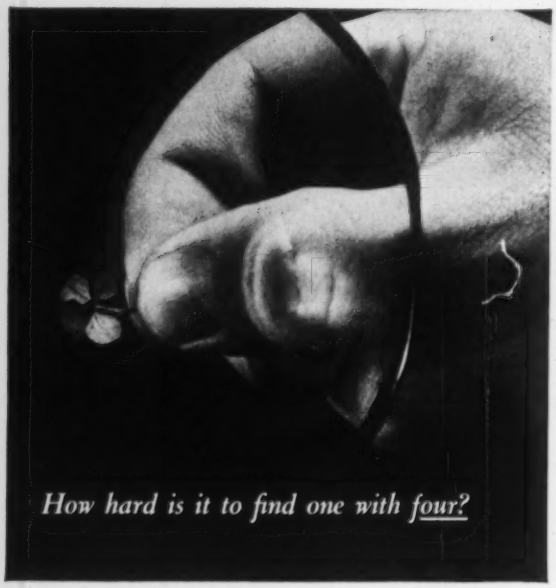
A complete package! Fire tested! Automatic, electronic controls. Meets all codes. Easy to install . . . Hev-E-Oil models from 5 to 150 gph. Also available, Hev-E-Duty power gas burners and combination gas/oil burners from 720,000 to 21,000,000 B.T.U.

For more information write Industrial Combustion, Inc., 4507 N. Oakland Ave., Milwaukee 11, Wis., Dept. HPA-9.

INDUSTRIAL COMBUSTION INC.

EXECUTIVE OFFICE: 4507 N. OAKLAND AVE., MILWAUKEE 11, WISCONSIN


How hard is it to find one with four?



When it's unit heaters . . .

When you want unit heaters you don't have to look far afield . . . or even look *over* the field. All you need do is look to Ilg. For *only* Ilg has everything you need in the way of unit heaters.

No matter what source of heat you prefer—gas-fired,

Only ILG *gives you*

Gas-Fired Unit Heaters. Ilg Model 35M—now the smallest and lightest 35,000 Btu./hr. input model on the market. Only 18" high, 14" wide, 66 pounds in weight. Complete line includes ten basic models from 25,000 to 250,000 Btu./hr. input. For use with natural, manufactured, mixed and liquefied petroleum gases.

All-Electric Unit Heaters. Pick any capacity from 1½ to 30 kw. and Ilg will furnish the unit you need. All heaters have non-glowing, steel sheathed heating elements . . . super-quiet aluminum fan wheel . . . permanently lubricated motor . . . built-in protection against overheating. All parts fully protected by Ilg's famous "One-Name-Plate" guarantee.

For unit heaters built to satisfy your "specs". . .

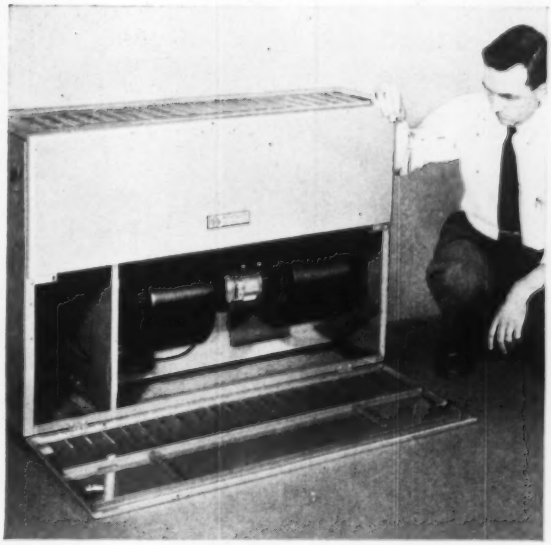
you're in clover when you look to ILG

all-electric, steam or hot water—Ilg has the unit to meet your demand, in a variety of types and sizes.

So why shop around? Put all unit heater responsibility on Ilg—the *only single source* that has all four types of heaters—and you eliminate heater headaches.

For further details, write for Bulletin 807 on electric heaters, Bulletin 1202 on horizontal and vertical heaters, Bulletin 286 on gas-fired heaters, Bulletin 1306 on cabinet heaters.

all four types of unit heaters



Steam and Hot Water Cabinet Heaters. Seven basic sizes; 21 hot water ratings; 14 steam ratings. Heavy-gauge steel casing. Choice of blow-through type with direct-drive fan assembly or draw-through type with belt-driven fan. Available for floor, ceiling, wall or inverted mounting; non-recessed, semi-recessed, fully recessed, or concealed installation.

Steam and Hot Water Horizontal and Vertical Heaters. *Horizontal* models in 19 capacities. Heating coils are rounded copper tubes hydraulically expanded for tight bonding to aluminum fins; totally enclosed motors. *Vertical* models in 15 capacities; two types—for standard and low outlet air temperatures. Coil construction similar to horizontal heaters.

specify ILG

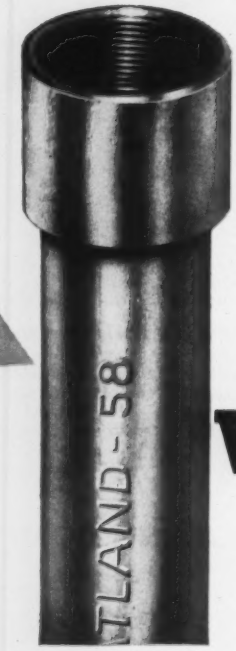
ILG ELECTRIC VENTILATING COMPANY
2826 N. Pulaski Road, Chicago 41, Illinois
Offices in 57 Principal Cities
Member of Air Moving and Conditioning Association Inc. (AMCA)

Wheatland Steel Pipe means Quality

. . . PLUS A LITTLE MORE

Wheatland gives you the finest quality steel pipe made. But Wheatland means a little *more*. It means people —men who have made pipe their life . . . your satisfaction their ultimate goal. The cold steel pipe they produce has warm concern behind it.

Yes, we sincerely believe you get *a little more* from Wheatland. Try us and see!



. . . pipe with the yearmark!

For information about Black or Galvanized Steel Pipe, contact

WHEATLAND TUBE CO.

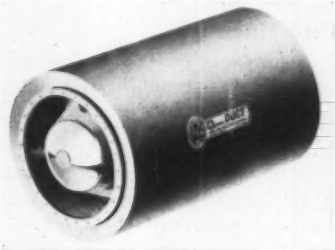
BANKERS SECURITIES BUILDING, PHILADELPHIA 7, PA.

MILLS: WHEATLAND, PA. • DELAIR, N.J.

EQUIPMENT DEVELOPMENTS

Continued from page 230

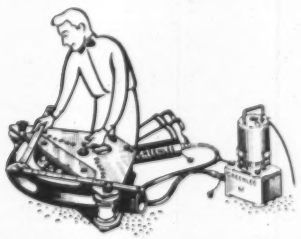
versible shaded pole motor, with motor, gear train completely submerged in oil. Standard units deliver to 220 psi torque at timing of 130 sec per 180 deg stroke. Adjustable units offering other limits of rotation, timings, torque ratings also available. Motor operator operates on 115 volts, 60 cycles, with input of 32 watts.



Duct Silencer . . .

. . . designed for installation in round duct systems with circular shape eliminating need for transition sections.—*Industrial Acoustics, Inc., Dept. HPAC, 341 Jackson Ave., New York 54.*

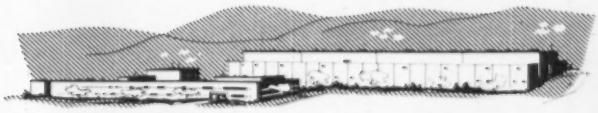
"Quiet-Duct" silencers are made in diameters 6 to 60 in., lengths 4 to 10 ft. Meet air flow specifications 100 to 100,000 cfm. Also available in special sizes to match inlet, outlet connections of axial flow fans. Shape of silencers said to make possible applications with pressures to 100 in. water gage.



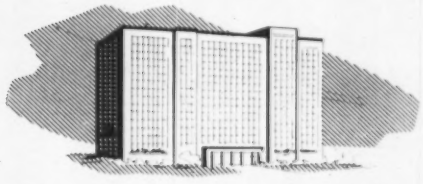
Angle Gage . . .

. . . designed to save time bending pipe, conduit—*Greenlee Tool Co., Dept. HPAC, 2136 12th St., Rockford, Ill.*

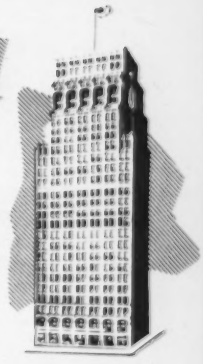
Special notched protractor allows exact degree of bend to be locked in, says manufacturer. Made of durable zinc plated steel with black figures, gage has overall length of 70½ in.



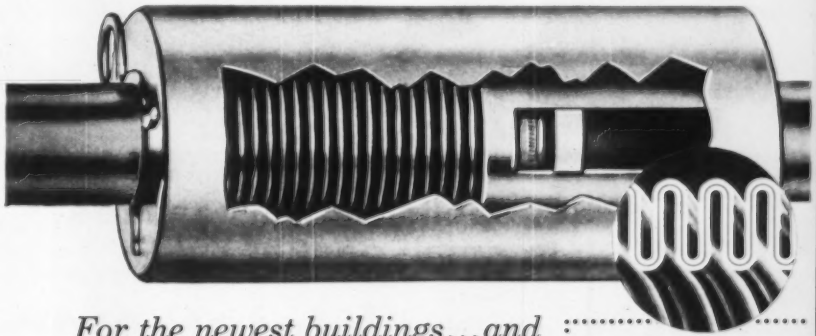
The Martin-Denver Company, Denver, Colorado



Stateway Gardens Apartments, Chicago, Illinois



Southwest Bell Telephone Company Kansas City, Missouri



For the newest buildings...and modernizing—**engineers specify**

Flexon

PACKLESS EXPANSION COMPENSATORS

The inside story
2-PLY CONSTRUCTION
The bellows is fabricated from two plies of specially-rolled metal for strength with flexibility. Bronze bellows for Model L; stainless steel for Model H.

All over the country, for the finest, most modern buildings, you'll find Flexon Expansion Compensators written into the heating specifications. Why? Simply because there's no substitute for their completely packless design, their easy installation, and the fact that they *never need maintenance!*

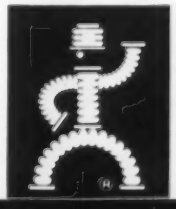
There's no easier or lower-cost way to take care of pipe and tubing expansion in mains, risers, and baseboard convector installations. A mechanic installs one in minutes; you can *forget it for the life of the building.*

Flexon Packless Expansion Compensators are the modern, low-cost way to absorb pipe motion, proved in thousands of installations. Why not write them into your next job? Write today for design and cost data, and the name of your Flexon representative.

SEND FOR YOUR COPY OF THE COMPLETE FLEXON DESIGN GUIDE—TODAY

Everything you need to know about absorbing pipe motion, in a concise 28-page design guide. Write for a copy for your reference files.

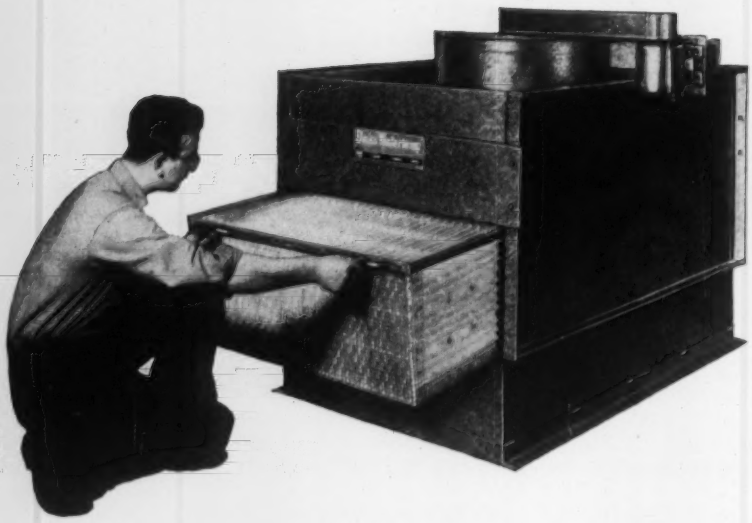
EC-125



Flexonics
corporation

EXPANSION JOINT DIVISION • 1391 S. THIRD AVENUE, MAYWOOD, ILLINOIS

EXPANSION JOINTS · METAL HOSE · NON-METALLIC HOSE · BELLOWS · AIRCRAFT COMPONENTS



Puts big cooling tower features in small package

Binks' new Watertemp

Small, compact, economical in cost, operation and maintenance—Binks Watertemp cooling towers are ideal for air conditioning installations in the 5 to 60 ton range. Base dimensions for the largest unit are only 7'6" x 12' and maximum over-all effective height is 5'.

Efficient counter-current water and air flow. A dynamic and static balanced fan mounted at the top of the tower draws air up through the decking. Water is brought in at the tower top under low head and flows down over the multi-finned plastic decking. No nozzles are required to effect initial water break-up.

Heavily galvanized after assembly. Metal framework, panels and all attachments are heavily galvanized after assembly. Special hot-dipped galvanizing deposits a 20% heavier thickness than established as standard by Federal and A.S.T.M. specifications. No additional painting or coating is required.

Easy to install and maintain. Only a simple mounting foundation is needed to support the tower package. Heavy galvanizing cuts metal maintenance to almost zero. The plastic internal decking unit slides out for cleaning and makes routine inspection and maintenance of the tower an easy job.

Send for complete data. Ask your Binks Branch Office, or write direct for the new Watertemp Bulletin. For larger induced and forced draft cooling towers, ask for Bulletin 477-A (Binks 3-B series) and Bulletin 333 (Binks 2-K series). Binks engineers will be glad to answer your questions and help solve your particular cooling problems. There is no obligation.

7936

Binks
EVERYTHING FOR WATER COOLING

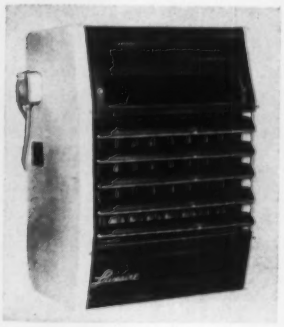
A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

Binks Manufacturing Company
3118-38 Carroll Ave., Chicago 12, Ill.

REPRESENTATIVES IN PRINCIPAL U.S. & CANADIAN CITIES • SEE YOUR CLASSIFIED DIRECTORY

EQUIPMENT DEVELOPMENTS

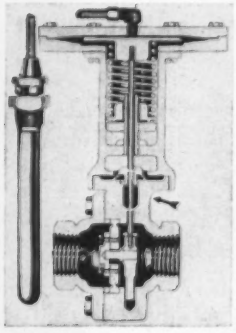
Continued



Unit Heaters . . .

. . . developed for installation in commercial and industrial buildings —*C. A. Olsen Mfg. Co., Dept. HPAC, Elyria, Ohio.*

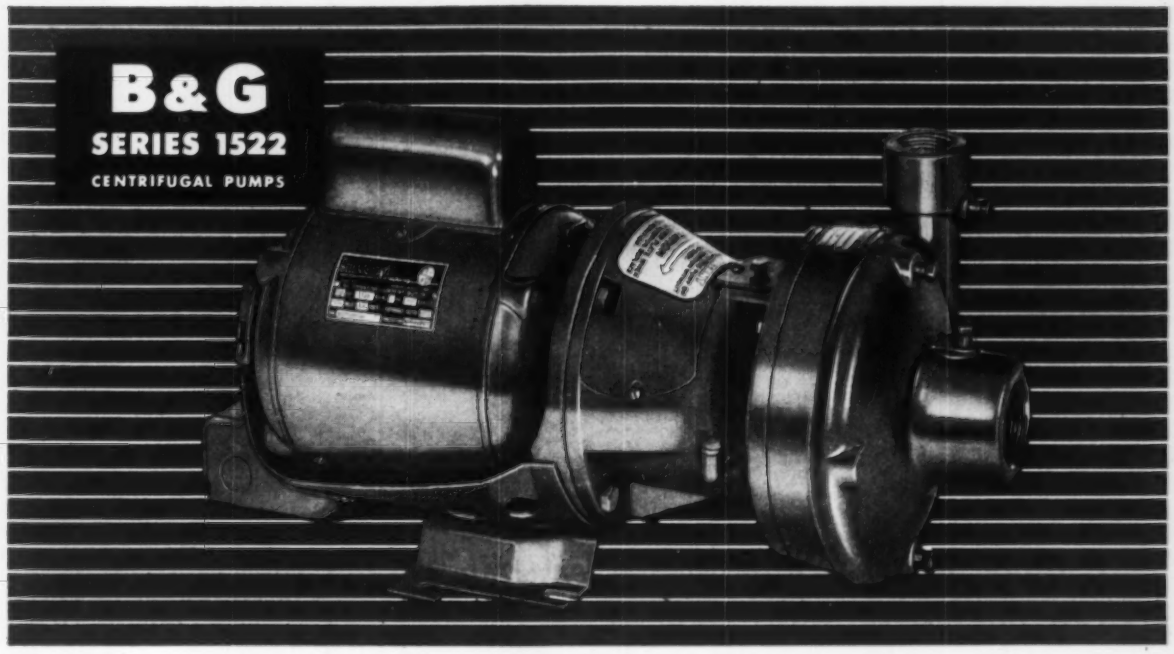
Recommended for natural, manufactured, mixed or liquefied petroleum gas, units available with heating capacities of 60,000, 90,000, 120,000, 180,000, 240,000 Btu per hr input. Three smaller sizes have single heating element and fan; two larger sizes have two heating elements, two fans, housed in same cabinet. Stainless steel ribbon burners inserted into tapered steel burner heads designed to provide efficient combustion.



Control Valves . . .

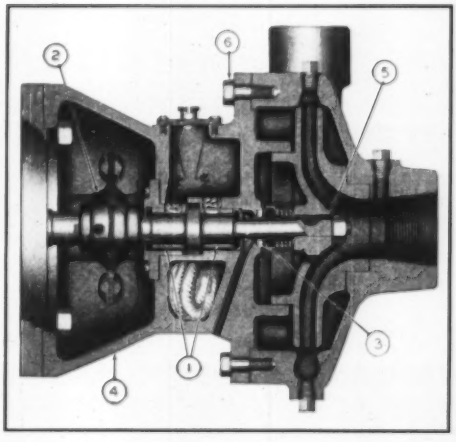
. . . now incorporating plastic impregnated asbestos stem packing.—*Jordan Industrial Sales Div. of OPW Corp., Dept. HPAC, 6013 Wiehe Rd., Cincinnati* 13.

Packing is inert, durable, will not shrink, swell, deteriorate, says manufacturer. Regulating valve stem movement allows diaphragm power to be transmitted more accurately to sliding gate seat. Valves available in ¼ through 2 in. sizes; 125 WSP cast iron and 250 WSP bronze bodies.



REALLY Quiet!

...your answer to noise problems in cooling tower installations



In the B&G Series 1522 Pump, noise has been engineered out... together with usual causes of unsatisfactory performance.

The cut-away illustration at left tells the story—

1. Long bronze sleeve bearings in both the pump and motor assure quiet operation.

2. Spring-type flexible coupling makes a noise-dampening connection between pump and motor.

3. "Remite" Mechanical Seal positively ends leakage. Harder than glass—wearproof—self-lubricating.

4. Bearing bracket sub-assembly, including shaft and sleeve bearing, is easily removed and is interchangeable in all B&G 1522 Pumps.

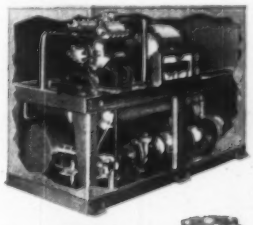
5. Dynamic balancing of the impeller prevents shaft vibration and seal failure. Balancing chamber and relief holes eliminate thrust load on pump bearings.

6. Easily serviced. Removal of a few bolts permits separation into three parts.

B&G Series 1522 Pumps are available as all-iron, bronze-fitted, all-bronze or stainless steel units. Capacities to 150 GPM, heads to 115 ft. Send for catalog.

COMPLETE LINE OF AIR CONDITIONING PACKAGE CHILLERS AND COMPONENTS

PACKAGE LIQUID COOLERS
Completely integrated cooling units for apartments, commercial and industrial buildings, process work



EVAPORATORS AND CONDENSERS
Plus values in efficiency designing—built to ASME Code requirements.

CENTRIFUGAL PUMPS
Featuring exclusive, leak-proof "Remite" Mechanical Seal—*quiet* operation. Ideal for air conditioning installations.

BELL & GOSSETT
COMPANY
Dept. RFK-5 Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

Society for Savings and Hartford National Bank & Trust Co.

West Hartford, Conn.

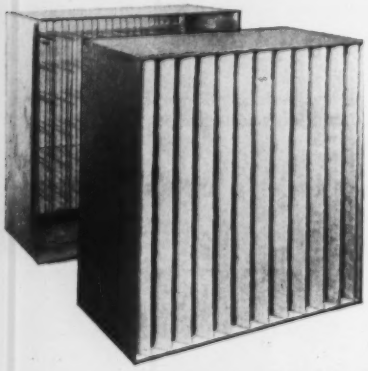
ARCHITECT	ENGINEER	GENERAL CONTRACTOR	VENTILATION CONTRACTOR
Jeter and Cook Hartford, Conn.	Van Zelm Associates West Hartford, Conn.	Industrial Construction Co. Hartford, Conn.	Homestead Insulation Co. East Hartford, Conn.

Unique Modern Banking Center Keeps Interior Bright and Clean with Cambridge AEROSOLVE® 85 Filters

An outstanding feature of this new banking center is the extensive use of colorful fabrics and bright walls and fixtures. Cambridge AEROSOLVE 85 Filters were selected to preserve the bright colors and avoid excessive maintenance costs by removing visible dust as well as the smudge-producing invisible particles which go right through ordinary filters.

Filters Serviceable Upstream or Downstream

Each bank in this center has its own air-conditioning system. In one, the AEROSOLVE filters are serviced from the upstream side; in the other, from downstream — a design feature which greatly simplified the air-conditioning layout.



Easy Servicing

The replaceable cartridges are held in permanent cadmium-plated frames and are secured by quick-acting fasteners. Beyond infrequent cartridge replacement, AEROSOLVE filters require no servicing or maintenance.

Flexibility to Meet Changing Needs

While AEROSOLVE 85 filters were installed as most suitable for the existing requirements, provision is made for changing to cartridges of higher or lower cleaning efficiencies as future conditions require. If dirt conditions in the atmosphere should become more severe, AEROSOLVE 95 filters can be substituted. Conversely, if filters of lower efficiency should prove adequate, AEROSOLVE 35 cartridges can be substituted. All AEROSOLVE cartridges are interchangeable.

Write for Bulletin 502

Cambridge Filter Corporation

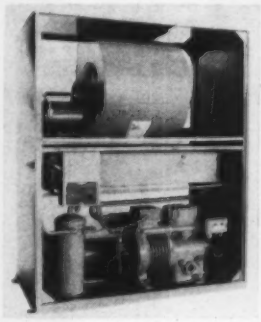
732 E. Erie Blvd., Syracuse 1, N. Y.

Pioneers in High Efficiency Filtration

REPRESENTATIVES IN PRINCIPAL CITIES

EQUIPMENT DEVELOPMENTS

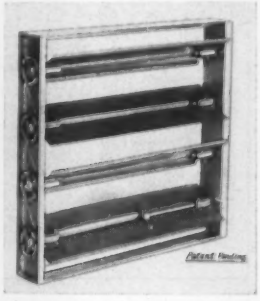
Continued



Packaged Chillers . . .

. . . in aircooled design—*Embassy Steel Products, Inc., Dept. HPAC, 890 Stanley Ave., Brooklyn.*

Chillers available in models 3 to 15 hp. Models 3 to 7½ hp have one chiller; models 10 and 15 hp have two separate chillers. Features cited: fully cork insulated; large surfaced condenser; copper tubing with aluminum fins used; equipped with charging valve, test cock to check refrigerant level. Dual pressure controls installed on all units, factory set. May be installed indoors or outdoors.



Damper . . .

. . . with interconnecting blades for parallel or opposed blade rotation—*American Foundry & Furnace Co., Dept. HPAC, Washington St. at McClun, Bloomington, Ill.*

"Roto-Link" principal links blades external to the airstream with cable belts and rotors fastened to each blade shaft. Torque requirements said to be reduced, uniform throughout entire blade travel; narrower blades may be used in opposed blade dampers; backlash of blades said to be eliminated.

Anything that can be made of steel sheets can be made of Wheeling SofTite Galvanized Sheets–that's been our challenge from the beginning. It stands today! For easily worked Wheeling SofTite Sheets have a galvanized coating that never flakes or peels ...no matter what the fabricating operation.

IT'S WHEELING STEEL

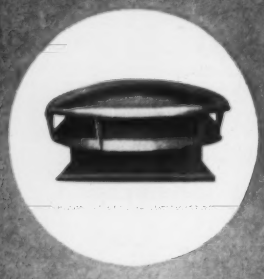
WHEELING STEEL CORPORATION, WHEELING, WEST VIRGINIA *District Sales Offices at Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Houston, New York, Philadelphia, St. Louis, San Francisco, Wheeling*

ACCEPTED
Allen
ROOF VENTILATION

Whatever your ventilating needs, be sure to see how Allen equipment can meet your requirements efficiently and economically.

NEW "I-LINE" for EYE APPEAL

The new "I-Line" provides an attractive low contour, assuring maximum capacity or efficiency with the minimum over-all height.



POWERFUL "VD" for HIGH VELOCITY

By moving a large volume of air at high velocity, this Vertical Discharge fan keeps fumes from sifting back into building.

Allen

. . . is prepared to investigate ventilating problems and plan systems for the efficient removal of heat, fumes, vapor or dust.

WIND-DRIVEN TURBINES

Three types of Allen turbines take full advantage of the economy of natural air movement.

EXHAUST FANS

Remote drive Staxauster is designed to handle corrosive fumes, and/or high temperature air.

THE ALLEN LINE

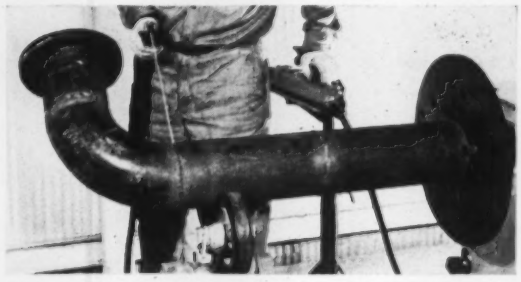
Write today for catalog that gives specifications and performance data on these and other units in the Allen ventilator line.

ALLEN COOLER & VENTILATOR, INC.
ROCHESTER, MICH.

Roof Ventilators for Every Commercial and Industrial Need
REPRESENTATIVES IN PRINCIPAL CITIES

EQUIPMENT DEVELOPMENTS

Continued



Pipe Machine . . .

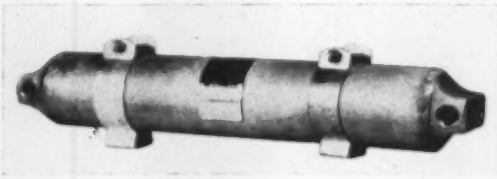
. . . developed for cutting, fitting, welding applications —*R. C. Porter Co., Dept. HPAC, 9354 Floral Ave., Cincinnati 42.*

Pipe ranging 1½ to 12 in. diam and up to 25 in. in length can be worked on unit. Pipe, cylinder to 30 in. diam can be rolled for welding. Flanges, elbows 1½ to 12 in. diam can be reclaimed. Models for larger, smaller size ranges can be constructed without loss of efficiency. Machine is driven by 1 hp motor (wired for various currents), a variable speed drive, standard compound reduction unit, pendant, portable, remote control with start, stop, reverse, variable speed change.

Tube Connector . . .

. . . with self-sealing, automatic locking feature—*Mechanical Products Corp., Dept. HPAC, 168 N. Ogden Ave., Chicago.*

"Push On-Pull Off" tube plug and connector attached by pushing end of tubing to stop position, automatically locking tubing into place in leakproof seal. Connector designer to operate any pressure to 1000 psi or high vacuum. Depressing thumb pad permits connector to be pulled off tubing. Designed for applications with air, water, steam, oil, refrigerant 12, refrigerant 22, etc. Suitable for temperatures −40 to 275 F. Available in standard tube sizes ¼ to 1½ in. diam.



Heat Exchanger . . .

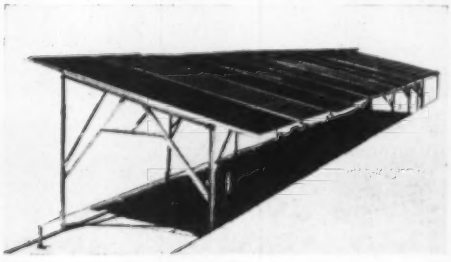
. . . in corrosion resistant stainless steel intended for applications in petroleum, chemical, process industries

EQUIPMENT DEVELOPMENTS

Continued

—*Hagan Chemicals & Controls, Inc., Dept. HPAC, 323 Fourth Ave., Pittsburgh.*

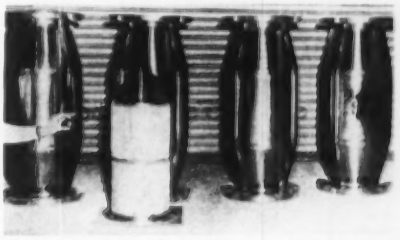
Counterflow heat exchanger has coil-within-shell construction. Recommended by manufacturer for cooling high temperature chemical solutions, process liquids at line pressures to 6000 psig prior to testing at atmospheric conditions. Available with screwed or ½ in. socket welding adapter sample connections, cooler can be integrated into piping system. Mounting also by clamp type brackets. Heat exchange area is 1 sq ft.



Air-Cooled Condenser . . .

. . . designed to make use of convection air currents—*Edwards Engineering Corp., Dept. HPAC, 101 Alexander Ave., Pompton Plains, N. J.*

"Airvec" mounted horizontally on building allows air to circulate through finned tubing. Heat rejected rises, draws cool air from below surface area. Condenser manufactured in four sizes: 2, 3, 5, 7½ tons; ratings determined by operation at temperature difference of between 25 and 30 F between the condensing temperature and the ambient air temperature.



Pipe Line Filters . . .

. . . for hydrogen peroxide, hydrazine, ethylene oxide, liquid oxygen, similar fuels, components—*Micro Metallic Div. of Pall Corp., Dept. HPAC, 30 Sea Cliff Ave., Glen Cove, N.Y.*

Filter uses "Regimesh" metallic filter medium with furnace-welded wire mesh, unalterable particle size retention rating. Filters shown above handle up to 5000 gpm of liquid oxygen, removing all particles over 40 microns in size. Small filter element filters 30 lb per min of nitrogen with 10 micron size retention rating.

Your ideas work better when you work with HONEYWELL

The following pages bring you the latest developments in automatic controls from Honeywell. They widen your choice of products, give you more to work with.

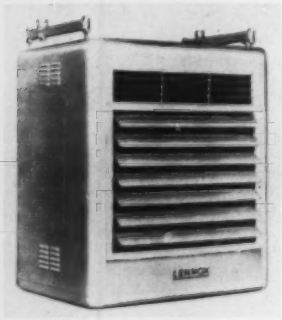
For complete information on these new control products and systems, call your nearest Honeywell sales office. Honeywell provides 112 offices throughout the country; each is staffed with capable control specialists to assist you in preparing proposals and writing specifications.

Look over these new products and systems. And, remember, they are backed by the kind of support only Honeywell can offer you.

FOR MORE TO WORK WITH ... WORK WITH HONEYWELL

EQUIPMENT DEVELOPMENTS

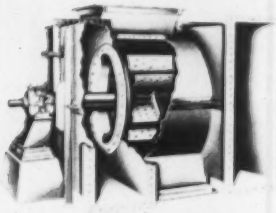
Continued



Unit Heater . . .

. . . designed for applications requiring direct, diffused warm air in less than extreme high output capacities—*Lennox Industries Inc., Industrial Div., Dept. HPAC,* 1701 *Euclid, Des Moines.*

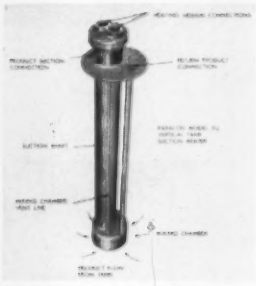
Gas unit heaters have vertical, horizontal louvers to diffuse warm air over wide area. Heat exchangers are 18 gage steel tubes with 16 gage aluminized steel header plates. Cabinet is of 20 gage cold rolled steel. Standard controls include automatic gas valve, 115 volt adjustable gas pressure regulator, high limit control, manual main gas, pilot valves. Six models available with output capacities of 64,000; 80,000; 96,000; 128,000; 160,000; 200,000 Btu per hr.



Mechanical Draft Fans . . .

. . . designed for handling abrasive gases at elevated temperatures—*Westinghouse Sturtevant Div., Dept. HPAC,* 200 *Readville St., Hyde Park, Boston* 36.

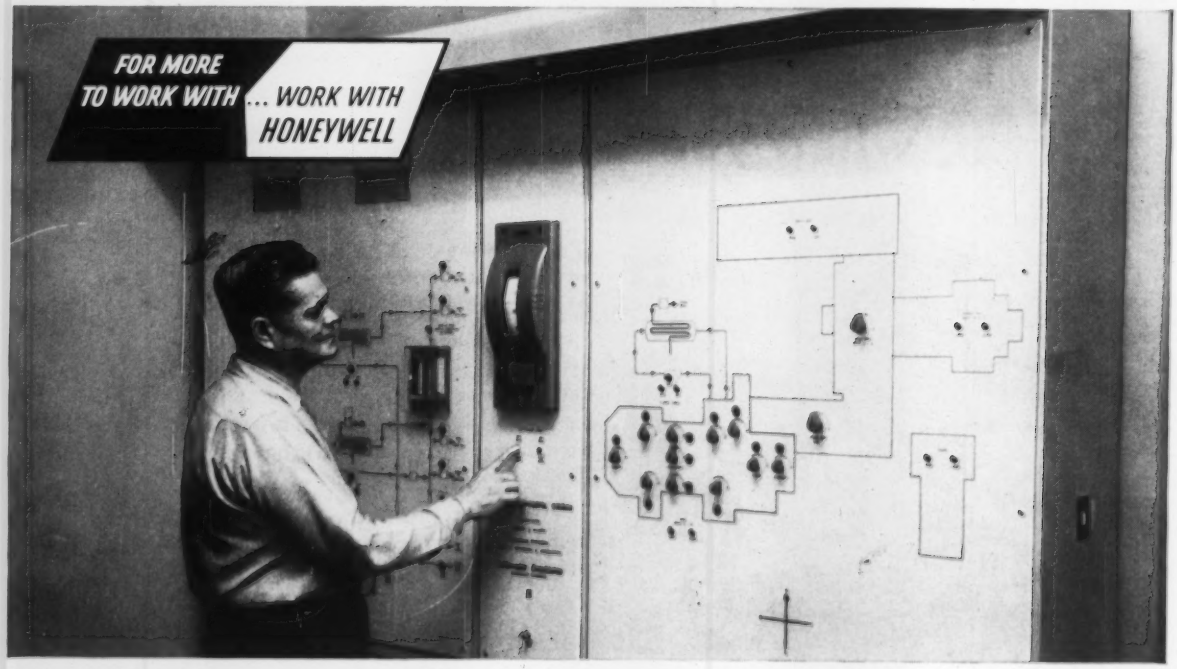
Fans available in ratings to handle 10,000 to 500,000 cfm, pressures to 70 in. of water, temperature range from 20 to 850 F. "Series 7000" designed for applications such as steam boiler gas recirculation, fly ash precipitator purging, induced draft for waste heat boilers. Unobstructed gas passage over open radial blades provides self-cleaning action for blades. Ribbed blade liners used for extra severe abrasive service. Optional blade, housing liners replacable in field.



Oil Tank Heater . . .

. . . designed to simplify inspection, servicing in underground storage installations—*Davis Engineering Corp., Dept. HPAC,* 30 *Rockefeller Plaza, New York.*

"Paracoil" vertical tank suction heater, "Model VU," is U-tube heater

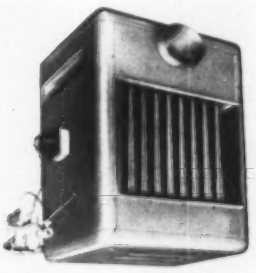


Honeywell Supervisory DataCenter in St. Mark's Episcopal Church, Shreveport, is located in the building engineer's office, provides one-man control for air conditioning of parish property including hall, chapel and school besides the church. Owners: St. Mark's Episcopal Parish; Architect: Annan and Gilmer; Consulting Engineers: Paul Rottmann & Associates.

EQUIPMENT DEVELOPMENTS

Continued

suspended vertically into tank from support plate resting on nozzle at top of tank with service connections outside tank in access chamber. Hot water or heat transfer liquids used as heating mediums. Recommended for heating viscous fluids to transport temperature suitable for pumping.



Unit Heaters . . .

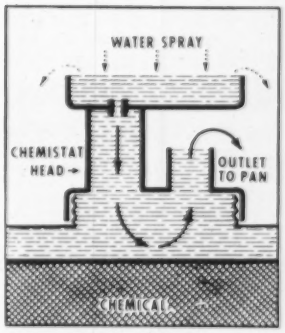
. . . in new range of sizes for commercial, industrial heating—*American-Standard, American Blower Div., Dept. HPAC, Detroit* 32.

Duct-type, gas-fired unit heaters have side-mounted gas controls, suitable for connection to either side. Units furnished with low-voltage control and 24 volt transformer having dual primary circuit suitable for 115 or 230 volt connection. New size range includes six models from 50,000 to 165,000 Btu per hr input.

Oil and Gas Fired Boilers . .

. . . in vertical design, requiring minimum of floor space—*Mears-Kane-Ofeldt Inc., Div. of S. T. Johnson Co., Dept. HPAC, Church Rd., Bridgeport, Pa.*

"MkayO" boilers built for pressure of 100 psi, equipped with safety valve set to relieve at 100 psi. Controls can be adjusted to automatically maintain desired working pressure below 100 psi. Units built to order for pressures of 125, 150, 200, 250, 300 psi. Boilers designed for operation on oil and combination oil and gas. Bulletin "E" gives full details, will be sent on request.



Corrosion Control . . .

. . . developed for applying chemical treatment to circulating water in air conditioning systems against corrosion, scales—*Water Service Laboratories, Inc., Dept. HPAC, 615 W. 131st St., New York* 27.

New method utilizes "Chemistat" proportional chemical feeder designed to be put into cooling tower or evaporative condenser or air washer so that spray water falls directly on it. Head on top of unit catches small amount of spray water, funnels it into chamber containing solid chemical. After contact with chemical,

Honeywell Supervisory DataCenter

increases efficiency, reduces air conditioning cost for any building—here, a church!

One of over 350* Honeywell Supervisory DataCenters sold throughout the country is illustrated on the opposite page. It provides supervision and control of the entire air conditioning system for St. Mark's Episcopal Church in Shreveport, Louisiana. One module of its panel shows the entire floor plan of the buildings with temperature check buttons and temperature adjustment knobs for eleven zones. Another module diagrams the entire hot and chilled water system, in color codes. A precision Tel-O-Set recording instrument located in the supply header flow diagram gives a continuous record of hot and chilled water supply to all units.

In this, as in all Supervisory DataCenter installations, the controls, instruments and central panel are manufactured, installed and guaranteed by Honeywell—a major central-control benefit only Honeywell can offer.

Working installations in all types and sizes of buildings across the country demonstrate clearly Honeywell's leadership in centralized air conditioning control. This experience is available to you at no obligation. A Honeywell specialist will be glad to work with you and your ideas from the original planning stage of any building. Just call your local Honeywell office for full details.

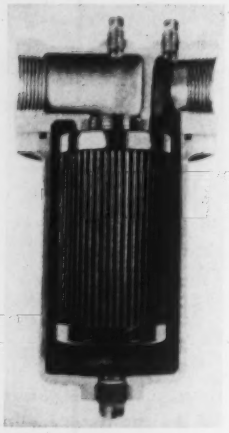
Honeywell* *List of installations, including those in your area, available on request.*

H First in Control

EQUIPMENT DEVELOPMENTS

Continued

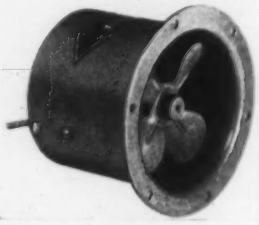
water flows out of container carrying controlled amount of chemical with it in solution.



Pipe Line Filters . . .

. . . intended for installation on suction or return line—*Marvel Engineering Co., Dept. HPAC, 7227 N. Hamlin Ave., Chicago* 45.

Filters intended for filtration of hydraulic oils, fire-resistant fluids, coolants, lubricants at operating pressures to 150 psi and temperatures to 300 F. Produced in 10, 20, 30, 50, 75 gpm sizes with choice of monel wire cloth mesh sizes 30 to 100. All units available with or without bypass valve. Provision made for vacuum or pressure gage or both.



Tubeaxial Blowers . . .

. . . for electronic equipment cooling —*American-Standard, American Blower Div., Dept. HPAC, Detroit* 32.

Small, compact tubeaxial blowers furnished in variety of shapes, sizes, finishes, mounting arrangements. Smallest of new units is "Model H-84236" shown above. Low-volume, high-speed fan recommended for cooling oscilloscopes, other electronic equipment, has 3-1/16 in. inside housing diam. The 1/200 hp unit operates at 7200 rpm, delivers 75 cfm of air at free delivery.

Duct Liner . . .

. . . designed for internal application on all rectangular and round metal ducts—*Owens-Corning Fiberglas Corp., Dept. HPAC, National Bank Bldg., Toledo* 1.

Glass fiber, mat-faced, flexible duct liner has low air friction coefficient when adhered to inside finished duct, may be used at velocities to 4000 fpm. Product is fire resistant, specially designed for heating, ventilating, air conditioning systems. Thermal conductivity: 0.24 at 75 F; noise reduction coefficient: 0.70 to 0.80 in 1 in. thickness. Liner manufactured in ½ and 1 in. thicknesses, widths of 24, 36, 48 in., roll lengths of 100 ft in ½ in. thicknesses, 50 ft in 1 in. thicknesses.

FOR MORE TO WORK WITH ... WORK WITH HONEYWELL

For your mechanical systems...
Honeywell's New Two-Position Fluid Power Valve

It's silent and ⅓ smaller than ordinary

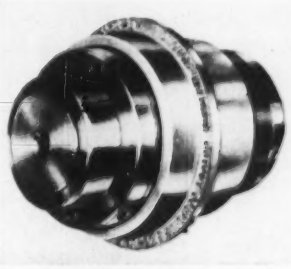
This new Electric Control Valve uses Fluid Power—an entirely new valve operating principle that produces two-position control in a smaller size. Operation is silent, with absolute freedom from maintenance or repair of the power unit. Because of the many exclusive new features of this Honeywell Fluid Power Valve, automatic control can now be applied where it has never before been possible or economically practical. This new valve is especially suitable for radiators, convectors and fan-coil units used for heating, cooling or year-round operation. And this new Honeywell Fluid Power Valve now makes modernization changeover to automatic control simple, inexpensive and trouble-free.

New V8025 Two-Position Fluid Power Electric Valve.

Propeller Fan . . .

. . . designed for applications where low pressure, high volume air is required—*American-Standard, American Blower Div., Dept. HPAC, Detroit* 32.

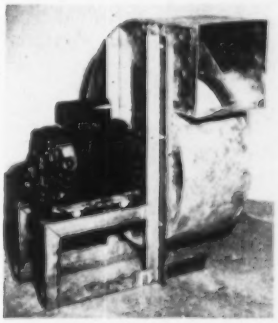
Fans available in variety of configurations, sizes, wheel designs to meet range of commercial, industrial, or military specifications. Model shown is "No. 89C15." Fan inlet, motor supports of model made of die-formed steel; fan wheel has aluminum blades. Motor treated for high humidity and anti-fungus. Rated at 1/6 hp, unit delivers 1300 cfm of air at zero water gage, and 1725 rpm.



Cut-Out Coupling . . .

. . . with overload protection, increased misalignment capacity, ease of maintenance features—*John Waldron Corp., Dept. HPAC, P. O. Box 791, New Brunswick, N. J.*

Torque sensitive "Anchor Waldron" cut-out coupling said to have instant power shutoff action at instant of dangerous overload. Increased misalignment capacity provides slight parallel misalignment, angular misalignment or combination of both. Coupling works regardless of direction of rotation. Only sleeve of coupling needs to be moved for maintenance.



Centrifugal Fan . . .

. . . for inflatable plastic structures—*Lau Blower Co., Dept. HPAC, 2027 Home Ave., Dayton 7, Ohio.*

Fans function under various climatic conditions of wind, precipitation, temperature with two speeds: one for rapid initial inflation of high wind conditions, one for normal input to keep structure up. Air delivery is 1635 cfm on high, 1000 cfm on low. Pressure change is from free air to 2.6 in. water gage. Many angles of air discharge possible, either clock-

electric valves

QUIET—As quiet as the flow of the fluid itself. No whirring of motors or gear trains. No solenoid click. And the valve actually gets quieter with age.

SMALL—Because Honeywell's new Fluid Power Valve is 1/3 smaller than even the most compact of old-style electric-motor valves, it makes possible automatic control in tight places—places where automatic control has been impossible before.

RELIABLE—No moving parts to wear out. No oiling is necessary. Honeywell's new valve lasts for years and years, saves more than its original cost on service alone.

RUGGED—Stem-and-seat construction as in the best commercial valves. Closes tight, lasts a lifetime.

FAST—This new two-position valve goes from fully open to fully closed or back again in four seconds flat—1/5 the operating time of electric motor valves.

To control Honeywell's new valve, specify the world's most popular thermostat—the Honeywell Round. Neat, unobtrusive, its beauty reflects the watchlike accuracy with which it's made.

Honeywell

H First in Control

EQUIPMENT DEVELOPMENTS

Continued

wise or counter clockwise. Provision can be made for either side structure air entrance or snorkel type air entrance.

Mat-faced Filter . . .

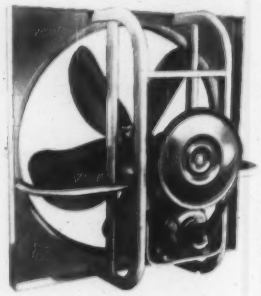
. . . designed primarily for paint spray booth—*Owens-Corning Fiberglas Corp., Dept. HPAC, National Bank Bldg., Toledo* 1.

Filter is produced in pad form with or without adhesive, intended for air cleaning of air streams not over 350 fpm.

Water Heaters . . .

. . . designed especially for large volume hot water service—*Federal Boiler Co., Dept. HPAC, Granite and West Sts., Midland Park, N.J.*

Series "FTHW" and "FMHW" heaters offered in two styles: horizontal fire box and scotch marine. Units use multi-pass copper coils, with greater water content, says manufacturer, providing fixed water temperature delivery. Both series can be piped for two or three different water temperatures to be delivered simultaneously to meet varying installation requirements. Offered in range of sizes, jacketed or unjacketed.



Propeller Fans . . .

. . . designed for maximum air delivery at low noise levels—*Power Line Fan Co., Dept. HPAC, 639 South Ave., Plainfield, N.J.*

"BV" belt drive fans intended for general ventilation applications where static pressure does not exceed 0.111 to 0.125 in. water gage. Features cited: all-steel welded construction; streamlined venturi orifice; precision balanced blades; low power consumption.

Gate Valve . . .

. . . incorporating seals in wedge—*Hamer Valves, Inc., Dept. HPAC, P. O. Box* 1851, *Long Beach* 1, *Calif.*

As wedge is lowered in "Wedge-Seal" valve to give metal-to-metal fit against seats, plastic seals on either side of wedge compress against seats to form double sealing action. Available in 150, 300 psi classes.

Air Conditioners . . .

. . . developed to provide volume range from 200 to 1400 cfm—*Ilg Electric Ventilating Co., Dept. HPAC,* 2850 *N. Pulaski Rd., Chicago* 41.

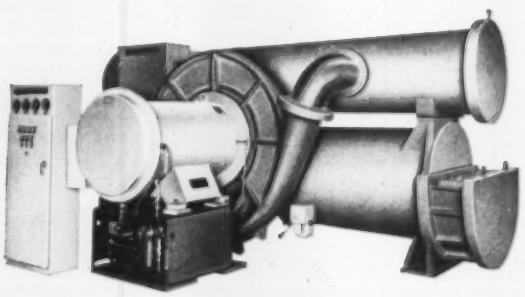
"Ilg-dualair" line of cabinet air conditioning units intended for year-

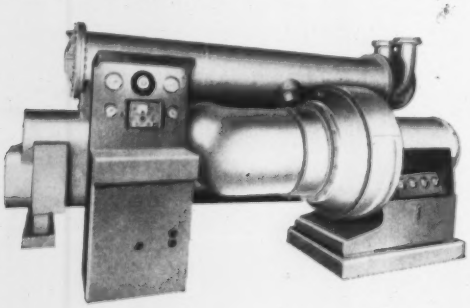
FOR MORE TO WORK WITH ... WORK WITH HONEYWELL

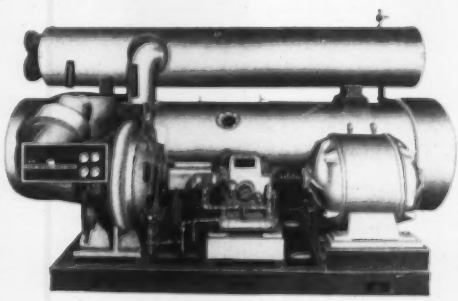
Honeywell Electronic correction of centrifugal

Leading manufacturers use Honeywell controls

Note the free selection of panel location permitted by these Honeywell electronic controls as they are used by leading manufacturers. They hold the chilled water in these machines within plus or minus 1½°—often within plus or minus ½°. The system does not require a wide throttling range, therefore there is little offset from the control point. The motor load limiting system on these controls provides instantaneous correction of vane position.



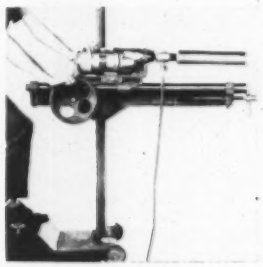




'round use with hot and chilled water. Cooling capacity: 1 to 5 tons; heating capacity: 25,000 to 100,000 Btu per hr. Units can be operated by pneumatic, electric, electronic, or manual controls. Cabinet interiors lined with layer of acoustical material for quiet operation.

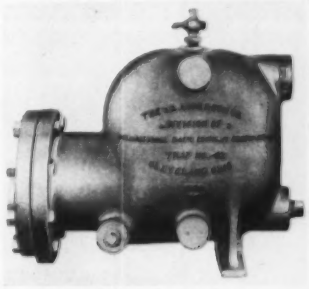
Electric Steam Generator
. . . developed to produce high pressure steam for process, cleaning, heating, auxiliary purposes—*Tejax Engineering Corp., Dept. HPAC, 130 Weeden St., P.O. Box 348, Pawtucket, R. I.*

"Jetstream" generator has electric heating element made of long life, heavy gage 80 percent nickel, 20 percent chromium alloy. Boiler designed to require minimum water volume for fast vaporization at rated power input. Maximum pressure of steam is 100 psig.



Drilling Machine . . .
. . . designed to swivel 360 deg to allow drilling in any direction—*Molco Drilling Machines, Inc., Dept. HPAC, 1100 20th St. N. W., Washington, D. C.*

Swivel action of drill suits it for use in installing pipes, ducts, water lines, etc. where many drilling operations must be performed in confined or poorly accessible areas. Using special thin wall diamond core bits, machine will drill holes as large as 6 in. diam through concrete, other hard building materials at 1 in. per min.



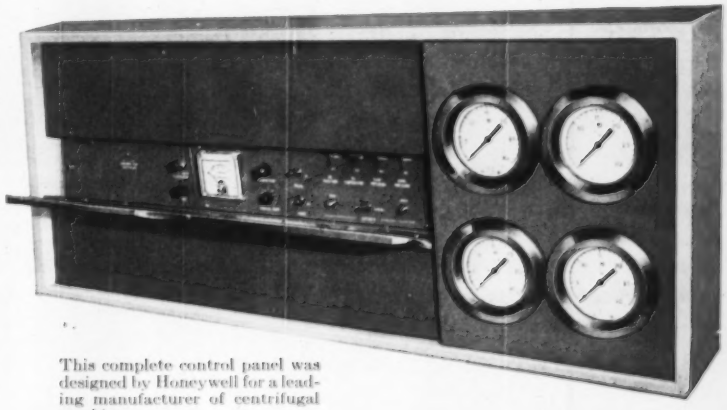
Float Traps . . .
. . . with increased capacities for draining condensate or moisture from steam, air, gas equipment—*International Basic Economy Corp., Dept. HPAC, 1935 W. 96th St., Cleveland 2.*

Controls give accurate sensing, rapid refrigerating machines

This Honeywell Electronic Control System combines the functions of chilled water temperature control and motor load control. Its application to centrifugal refrigeration offers your clients these important advantages:

- Rapid, accurate control of chilled water temperature; instant, positive correction.
- Maximum input current can be set at any predetermined value by a simple adjustment of the load limiting switch.
- The simplest, most trouble-free control of temperature and motor current.
- Consolidates all equipment in one location, permits setup, adjustment and service from the central panel, keeps adjustments secure in a tamper-proof enclosure.
- Permits free selection of panel location—troublesome capillaries are eliminated.

For further information call your nearest Honeywell office. Or write Minneapolis-Honeywell, Department AC-9-103, Minneapolis 8, Minnesota.



This complete control panel was designed by Honeywell for a leading manufacturer of centrifugal machines.

Honeywell
First in Control

Underground hot pipes stay free from trouble...when you INSULATE WITH GILSULATE

One of the most difficult problems in designing underground hot piping systems is providing positive corrosion protection against electrolytic, chemical or galvanic attack. The answer lies in the use of GILSULATE. For, in addition to its excellent insulating properties, this naturally-occurring hydrocarbon is chemically neutral in all soils, dielectric, and moisture-proof and water-proof as well.

GILSULATE's low thermal conductivity, low cost and easy installation make it possible for schools, colleges, housing projects, hospitals, industrial plants and other institutions to install central heating with underground piping and to realize the savings in equipment and operating costs which such systems provide.

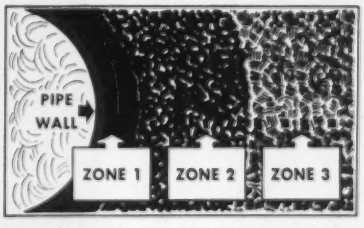
We'll help you with your plans

If you are planning to rehabilitate present piping, or to install a new underground hot piping system, call the nearest GILSULATE Distributor listed on the page opposite this advertisement. His own extensive experience in heating and air conditioning, plus the research, engineering and field supervision facilities of the American Gilsonite Company are at your disposal...without obligation. They will work with your engineers in checking specifications, unusual soil conditions, and actual installation to make sure that the finished job is completely satisfactory.

If you would like complete information on GILSULATE insulation, or would like to be put on the mailing list to regularly receive free copies of PIPE INSULATION NEWS, send your request to any of our offices.

GILSULATE IS EASY AND ECONOMICAL TO USE

GILSULATE completely frees you of the expensive, time-consuming preparation required by many insulating systems. You just pour it into the pipe trench, shovel-point it around the pipes, and tamp it. Pipe heat does the rest.



Heat fuses the GILSULATE to pipes and joints to form three zones: Zone 1, a flexible, heavy-duty water barrier; Zone 2, of firmly-cemented granular GILSULATE that provides excellent thermal insulation under wet or dry conditions; and Zone 3, which provides a final zone of thermal insulation and a support for the water-proof structure.

GILSULATE®
TRIPLE ZONE INSULATION
FOR UNDERGROUND HOT PIPES

AMERICAN GILSONITE COMPANY
Affiliate of Barber Oil Corp. & Standard Oil Co. of Calif.
134 West Broadway, Salt Lake City 1, Utah
3537 Lee Road, Cleveland 20, Ohio
Distributors in Principal Countries of the World

GILSULATE DISTRIBUTORS

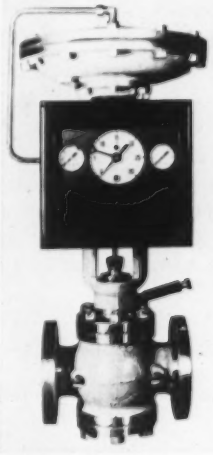
Ask for a demonstration of
GILSULATE's unique properties

ALABAMA
Palmer & Lawrence,
3110 Clairmont Ave. So., P.O. Box 1572, Birmingham
ARIZONA
Carns-Hoaglund Company, 420 N. 15th Avenue, Phoenix
CALIFORNIA
Industrial Insulators, Emeryville & Los Angeles
COLORADO
Joy and Cox, Inc., 2124 Broadway, Denver 2
CONNECTICUT
A. F. Hinrichsen, Inc., P.O. Box 446, Stratford
FLORIDA
George A. Israel, Jr., Jacksonville, Miami & Tampa
Manufacturer's Sales Co.,
1826 No. Pace Blvd., Pensacola
GEORGIA
John A. Dodd Co., 299 Techwood Drive, N.W., Atlanta
ILLINOIS
Eagle Industrial Co., Inc., 1021 N. 18th St., E. St. Louis
Roy O. Nelson Company, 330 S. Wells St., Chicago 6
INDIANA
Jackson Engineering Co., Inc., Ft. Wayne, Indianapolis,
Lowell & Terre Haute
IOWA
Allied Industries, Inc., 2727 Middle Rd., Davenport
KENTUCKY
Jackson Engineering Co., Inc.,
660 S. 5th St., Louisville 2
LOUISIANA
Edgar Murray Supply Co., Inc.,
232 Canal St., New Orleans 6
MARYLAND
Freemire & Associates, Inc.,
2802 Ridgewood Ave., Baltimore 15
MASSACHUSETTS
Beaulieu and Munroe, 82 Crescent Avenue, Boston 25
MICHIGAN
John F. Wolff Company, 726 Lothrop, Detroit 2
MINNESOTA
Paul W. Abbott Co., Inc., 704 Vandalia St., St. Paul 14
MISSOURI
Anderson-Stolz Corp., 1727-33 Walnut St., Kansas City 8
NEW JERSEY
A. F. Hinrichsen, Inc., 9 Ampere Parkway, East Orange
NEW YORK
Ashley Equipment Corp., Albany–Saratoga Rd., Cohoes
H. V. Boggs Co., Inc., 419 E. Jefferson St., Syracuse 2
A. F. Hinrichsen, Inc., 50 Church Street, New York 7
J. B. Magee Assoc., 349 Franklin St., Buffalo 2
NORTH & SOUTH CAROLINA
Applied Engineering Co., Greensboro, N.C.,
& Orangeburg, S.C.
NORTH & SOUTH DAKOTA
Lignite Combustion Engineering Corp.,
215 Airport Rd., Bismarck, N.D.
OHIO
William G. Jewett Co., 33697 Aurora Rd., Solon
The Henry P. Thompson Co., Cincinnati & Columbus
OKLAHOMA
Loeffler-Greene Supply Company,
1604 N.W. 5th, Oklahoma City
OREGON
Winsor Co., 20031 Marine View Drive S.W.,
Seattle 66, Washington
PENNSYLVANIA
Holly Specialties Co., Inc.,
Walnut & 63rd Streets, Philadelphia 39
J. F. Scouler Company, 2120 Market St., Camp Hill
Tutein Equipment Co., P. O. Box 4453, Pittsburgh 5
TENNESSEE
John M. Dooley & Assoc., 1832 McCalla Ave., Knoxville
Hurston-Conaway, Inc., 2470 Poplar Avenue, Memphis
TEXAS
J. R. Dowdell & Co., Austin, Corpus Christi, Dallas,
Ft. Worth, Houston, Lubbock, San Antonio
UTAH
Williams, Gritton & Wilde, 204 Dooly Bldg., Salt Lake City
VIRGINIA
Shultz and James, Inc., 9 E. Cary St., Richmond 19
WASHINGTON
Winsor Co., 20031 Marine View Drive S.W., Seattle 66
CANADA
Banton Engineering Specialties,
360 Richmond Road, Ottawa, Ontario
Canwest Industrial Products,
1210–11th Ave., S.W., Calgary, Alberta
Engineering Equipment Co., Ltd.,
874 Beaumont Ave., Montreal, Que.
Insul-Mastic Corporation, Ltd.,
1400 Spruce St., Winnipeg, Manitoba
Perry Products Ltd.,
586 West 6th Avenue, Vancouver 9, B. C.
Michael Stuart Co., Ltd.,
102 Eglinton Ave. E., Toronto, Ontario

EQUIPMENT DEVELOPMENTS

Continued

Capacity of continuous flow type traps range as high as 32,000 lb of water per hr, depending on differential pressure. Head, body made of rugged cast semi-steel, with valve and seat of corrosion resistant nickel alloy. Other internal parts of stainless steel or bronze. Furnished with or without gage glass and in three sizes: "No. 82," ½ or ¾ in.; "No. 83," 1 in. or 1¼ in.; "No. 84," 1½ or 2 in.



Indicating Controller . . .

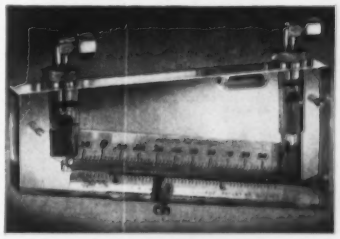
. . . intended for temperature or pressure control—*U.S. Gauge Div. of American Machine and Metals, Inc., Dept. HPAC, Sellersville, Pa.*

Unit is 8½ in. sq. 4 in. deep, can be surface mounted on equipment, flush mounted on instrument boards or directly on pneumatic valve it positions. Indication of measured variable made on 3½ in. precision gage dial (6¾ in. scale length). Modes of pneumatic control: two-position with differential gap, adjustable 1 to 100 percent; proportional control, adjustable 1 to 100 percent; proportional control (1 to 150 percent) plus automatic reset or rate action. For temperature measurements, bulbs offered for temperatures —350 to 1000 F. For pressure measurements, pre-calibrated Bourdon tube and movement with integral dial, pointers provide for ranges zero to 15 psi to zero to 10,000 psi. Accuracy is 1 percent in middle half of scale, 1½ percent for remainder.

FILTER EFFICIENCY

at a glance...

ANYTIME!



Dwyer

AIR FILTER GAGE

With the Dwyer Air Filter Gage you can be sure of maximum filter efficiency because you know the *exact* time to replace filters, *every time*. Gives a continuous, accurate check that spots inefficient filters, yet prevents waste through premature replacement.

The Dwyer measures filter efficiency the only practical and economical way—via pressure drop. Quickly pays for itself through savings in replacement and service time and greater operating efficiency.

Break-proof plastic construction, lifelong accuracy, simple installation, no moving parts to ever wear out or get out of adjustment. Ranges 0-½", 0-1", 0-2" and 0-3" water. A complete unit with all necessary tubing, fittings, etc.

Write for Bulletin C10

F. W. DWYER MFG. CO.

P. O. Box 373-H • MICHIGAN CITY, IND.

MEADOW BROOK NATIONAL BANK BANKS ON G-B FOR...

Quiet Fan Operation

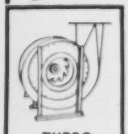
GEN. CONT'R.
J. J. Dixon Co., Inc.
HEAT. VENT. CONT'R.
A. I. McFarlan Co.
ARCHITECT
W. T. Schaardt

This G-B backward blade blower delivers up to 100,000 CFM with wheel diameter of 66" at 2" static pressure. (Request bulletin BB-105).

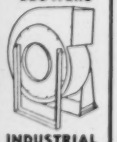
In the new seven story Meadow Brook bank building, Hempstead & Woodview Rd., West Hempstead, N. Y., large air volume must be handled with a mere whisper of sound.

To provide summer air conditioning as well as year round ventilating, Meadow Brook uses a single central air conditioning system. This installation operated thru the hottest New York summer on record, always providing lower than guaranteed temperatures.

The system is served by a GENERAL DIDW non overloading backward blade fan like the one shown above. The result —complete "sound proofing", maximum blower economy.



TURBO BLOWERS



INDUSTRIAL FANS

CENTRIFUGAL FANS BACKWARD BLADE FORWARD CURVE

GENERAL BLOWERS ARE CUSTOM ENGINEERED

AMERICA BREATHES EASIER with "Lungs for Industry"

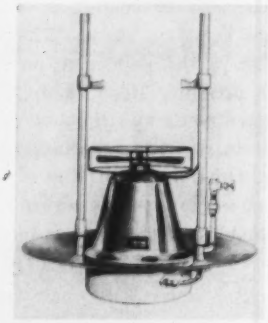
Over 20 years of engineering and manufacturing experience

GENERAL BLOWER COMPANY

8610 FERRIS AVE., MORTON GROVE, ILL.

EQUIPMENT DEVELOPMENTS

Continued



Humidifier . . .

. . . in self-contained design—*Standard Engineering Works, Inc., Dept. HPAC, 289 Roosevelt Ave., Pawtucket, R.I.*

"Model IH27-B" completely packaged unit for single or multiple installations. Features cited: horizontal distribution of humidity vapor; can be mounted for high or medium height ceiling rooms.

Liquid-Level Controls . . .

. . . designed for precise control of liquid level—*Magnetrol, Inc., Dept. HPAC, 2110 S. Marshall Blvd., Chicago 23.*

Small movement between contacts said to provide high sensitivity to level change in single-stage, narrow-differential liquid level controls. Liquids of specific gravity 0.30 and up temperature to 500 F can be controlled. ≠

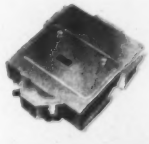
BUENSOD DUAL-DUCT UNITS, NOTED FOR FLEXIBILITY, CONDITION YEAR-AROUND

In the photograph on the facing page, the familiar tools of your profession symbolize the heart of one of the most flexible air conditioning systems ever developed. The system is the high pressure Dual-Duct method. Simply and efficiently it cools, heats, humidifies or dehumidifies a building. And it provides widely varying temperature and humidity conditions, where desired, from room to room.

The problem was to make such a system *stable*. Buensod engineers invented *direct, automatic volume control*. As pressures in the system change, each mixing unit automatically adjusts to maintain a constant quantity of air.

The action is something like the compass in our photograph on the adjacent page. That's how simple it is — but this is inspired simplicity, for the automatic volume control permits quick balancing of an entire system merely by adjusting spring tension at the time each unit is installed. Or we can pre-balance an entire system at our factory, saving time on your job.

Type VJ Air Mixing Unit for under window or wall mounting.



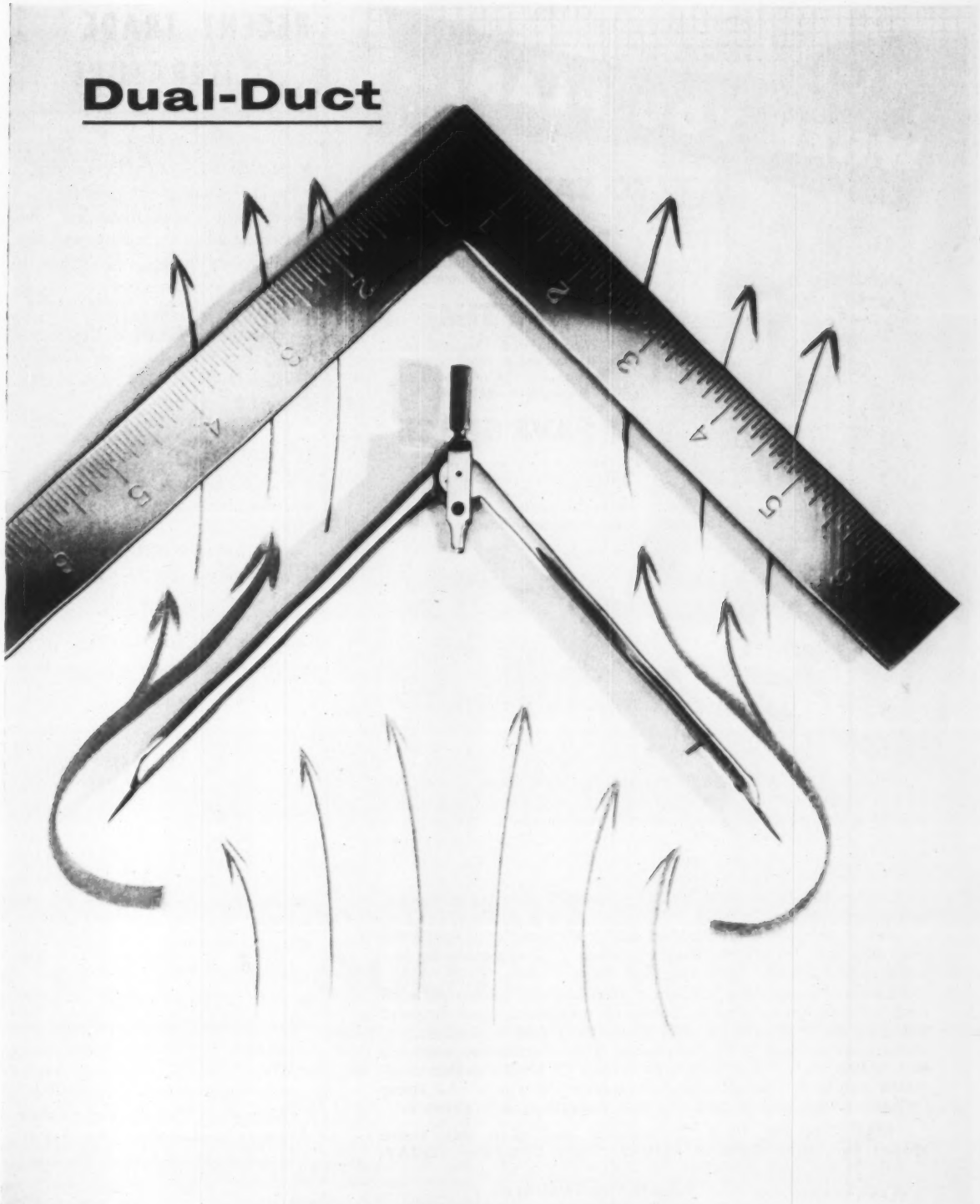
Type H unit for overhead installations

Buensod Dual-Duct Air Mixing Units offer true simplicity in air conditioning. We'd like to provide you with full technical details. Please contact our local representative, or write us directly.

BUENSOD-STACEY, INC.
45 West 18th Street • New York 11, N. Y.

BUENSOD-STACEY INCORPORATED

SIM in air



PLICITY
conditioning DESIGN

WHEN YOU PLAN...
TO SAVE COSTS
Factory-trained Cyclotherm engineers will . . . without charge . . . work with you from drafting board to final installation to estimate your steam demands.
TO SAVE TIME
Factory-trained Cyclotherm servicemen are as close as your telephone . . . at any hour of the day, night or week-ends.
TO SAVE SPACE
Cyclotherm Steam Generators range from 15 to 750 hp. . . , from 15 to 200 psi. For industrial and commercial establishments, shipping, institutions.
Select
CYCLOTHERM
STEAM
& HOT WATER
GENERATORS

Planning a new building? Remodeling an existing structure? As much as ⅓ smaller than other packaged units, the Cyclotherm Steam or Hot Water Generator allows more space for storage and production. Needs only a minimum-sized, minimum-cost boiler room. Or your Cyclotherm can be placed in a working area. Its radiant heat loss is at a minimum.

Lighter-weight, it costs less to transport. Simpler in design, it requires less rigging time . . . lower rigging costs.

Yet it delivers a guaranteed 80% efficiency . . . pays for itself in a few years in fuel savings alone . . . cuts maintenance costs up to 50%.

Exclusive, patented Cyclonic Combustion combined with simplicity of boiler design produces maximum heat transfer wringing every degree of heat from each fuel molecule . . . wasting none. Does in 2 passes what other combustion methods accomplish in 4. Cyclotherm's even rate of heat transfer eliminates localized, heat-retarding scale and "hot spots." All these features assure you of long life and maximum performance.

FREE **Discover how Cyclotherm can give you more steam for your dollar. RETURN THIS COUPON TODAY.**

YEARS AHEAD IN STEAM & HOT WATER GENERATION
CYCLOTHERM
STEAM AND HOT WATER GENERATORS

A Division of National-U.S. Radiator Corp., Oswego, N.Y.

Clip to Your Letterhead

Cyclotherm Division
National-U.S. Radiator Corp.
55 E. First St., Oswego, N. Y.

☐ Please send me your illustrated folder on Cyclotherm Hot Water Generators.

☐ Please send me your illustrated folder on Cyclotherm Steam Generators.

RECENT TRADE LITERATURE . . .

▸ *ADHESIVES, COATINGS*—New, 23 page catalog lists official U.S. Government specifications for wide variety of adhesives, coatings, sealers. Catalog lists military, army, federal specifications, definitions, corresponding adhesive, coating, sealer to meet specifications. *Minnesota Mining and Mfg. Co., Adhesives and Coatings Div., Dept. HPAC, 411 Piquette Ave., Detroit 2.*

▸ *AIR COOLED CONDENSERS*—New engineering bulletin describes broadened ranges of application for company's air cooled condensers. Remote, self-contained 1, 2, 3 fan types (in capacities 3 to 25 tons) said to be suitable for air conditioning, refrigeration applications, indoor and outdoor. *Drayer-Hanson, Div. of National-U.S. Radiator Corp., Dept. HPAC, 3301 Medford St., Los Angeles 63.*

▸ *AIR CONDITIONERS*—Recently published bulletin "No. 786" describes new line of air conditioning units with "Roll-O-Vent" automatic air filter. Bulletin details entire line in text, illustrations, specification charts, diagrams. *American Air Filter Co., Inc., Herman Nelson Div., Louisville 8, Ky.*

▸ *AIR CONDITIONING UNITS*—New, 15 page, illustrated catalog presents manufacturer's complete line of air conditioning products. Among new products presented in catalog is "Thermobank" compressor system. *Kramer Trenton Co., Dept. HPAC, Olden and Breunig Aves., Trenton 5, N. J.*

▸ *AIR DIFFUSERS*—Newly released, 20 page catalog "TMD—6-58" gives details on company's new line of "Series TMD" square and rectangular air diffusers. Engineering section facilitates selection for

Complete-line air-conditioning lets Worthington dealers

CUSTOM-QUOTE EVERY JOB!

Probably the most complete line of air conditioning equipment in the world—*Worthington, naturally*—is signing on a select group of new air conditioning dealers—*yourself, possibly?*

Many, many different models permit these *fortunate* dealers to put together the most efficient and economical combinations of air conditioning equipment for any *specific* job. Handling *exactly* the right equipment for every air conditioning problem eliminates equipment compromises, means these *smart* dealers can "custom-quote" on every job. And behind this job-tailored equipment stands 70 years of respected Worthington experience and front-line service. (Incidentally, these same *intelligent* new dealers will find that Worthington equipment is backed by a 5-year warranty which includes a generous dealer labor allowance.)

Interested in quoting on equipment fashioned to the job, not jobs fashioned to the equipment? Interested in increasing your sales, cutting down on lost orders? If so, *Worthington wants you—and you'll want Worthington.* Write today for the complete air conditioning story. Worthington Corporation, Air Conditioning and Refrigeration Division, Section 12-4, Harrison, N. J.

WORTHINGTON

WORTHINGTON'S COMPLETE COMMERCIAL AND INDUSTRIAL AIR CONDITIONING LINE INCLUDES:

Flexi-cool line: Air-cooled, ceiling-mounted, split systems • Water-cooled, self-contained, ceiling-mounted units • Smallest floor-mounted unit available • Hang it, lay it down, stand it up • Vertical and Horizontal cooling coils • Remote water-cooled packaged unit • Water-cooled self-contained packaged unit • Air-cooled packaged units • Air-cooled condensers • Air-cooled condensing units • Packaged water chillers—hermetic and open • Reciprocating compressors • Air handling units • Evaporative coolers • Evaporative condensers • Fan and coil units

"ENTERPRISE Burners perform to our fullest expectations —year after year"

Says Otto Walters, Head Custodian, Capuchino High School, San Bruno, Calif.

Users, Engineers, Contractors—all agree:

"Everyone Benefits When It's an Enterprise"

The man who's on the job with heating operations day after day has the facts. At the modern, two-level Capuchino High School facility – which includes fifty-one class rooms, heated pool, gym, theater, auditorium, cafeteria, shops and kitchen–this man is Head Custodian Otto Walters. His four Enterprise Burners have delivered smooth, trouble-free service for both class rooms and hot water needs 5 days a week for nearly eight years.

On-the-job performance such as this naturally scores big with everyone down the line–dealer, engineer, contractor and user. Check the facts– you'll learn that the men who specify and work with Enterprise have found the best burner buy!

Fit your specifications to the *right* burner model from the complete range of Enterprise Burner sizes shown here:

HORIZONTAL ROTARY OIL BURNERS, & COMBINATION OIL & GAS BURNERS

INPUT				OUTPUT		
Burner Size	Motor HP	Oil-GPH Max	Gas CF/HR	Steam LBS/HR	Steam BHP	Radiation-Sq. Ft. Steam
AA	½	4	600	464	13	1880
A	½	7	1050	812	23	3280
C	½	15	2250	1740	50	7050
E	½	20	3000	2320	67	9400
F	¾	30	4500	3480	100	14100
G	1	35	5250	4060	118	16400
H	1	50	7500	5800	168	23400
H	1½	60	9000	6960	201	28200
J	2	75	11250	8700	250	35250
K	3	100	15000	11600	336	46900
L	3	135	20250	15660	453	63400
M	5	200	30000	23200	672	94000

The Choice of Heating Experts

ENTERPRISE

DEPENDABLE BURNERS

ENTERPRISE ENGINE & MACHINERY CO. • 18TH AND FLORIDA STS., SAN FRANCISCO, CALIFORNIA

RECENT TRADE LITERATURE

Continued

wide range of applications. *Titus Mfg. Corp., Dept. HPAC, Box 810, Hiway 20 West, Waterloo, Iowa.*

▸ *AIR FILTERS*—Bulletin "No. 130" compares company's new high velocity "Aerosolve" filters to their standard line. New filters handle 80 percent more air volume per sq ft of face area at no increase in pressure drop. Design face velocity of new filters is 450 fpm, resulting in rated capacity of 1800 cfm for 24 × 24 in. size. *Cambridge Filter Corp., Dept. HPAC, 738 E. Erie Blvd., Syracuse 3, N.Y.*

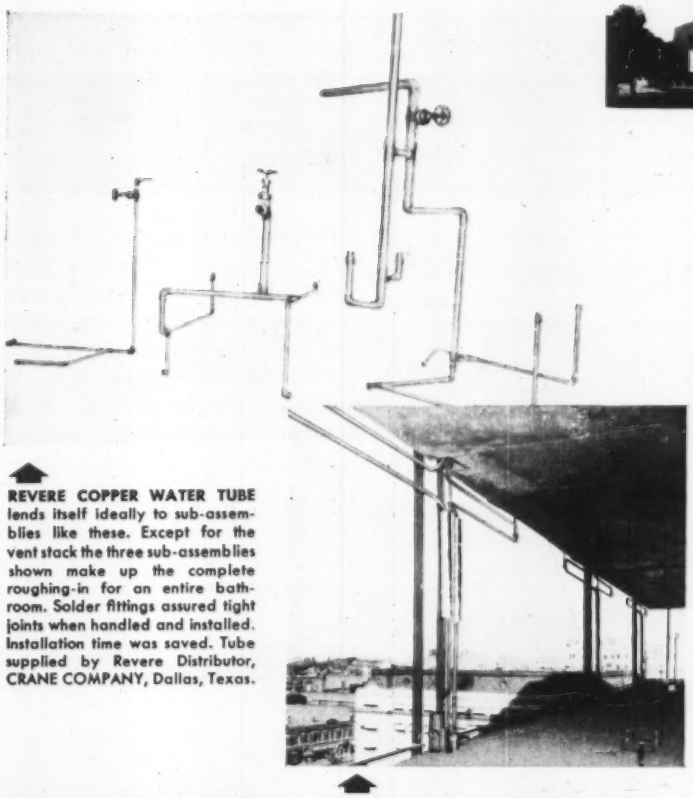
▸ *AIR TREATMENT, DISTRIBUTION*—"Westinghouse Puts Air To Work" is title of new booklet "D-5199" covering treatment, distribution of air with company's products. Booklet has sections on air handling, air conditioning, air heating, electronic air cleaning. *Westinghouse Sturtevant Div., Dept. HPAC, 200 Readville St., Hyde Park, Boston 36.*

▸ *AUTOMATIC VALVES*—New condensed catalog "P&H-58" gives information on company's line of valves, including 19 new and previously unlisted models. Specification tables included giving information on type, size, rating, weights. *A. W. Cash Valve Mfg. Corp., Dept. HPAC, 666 E. Wabash Ave., Decatur, Ill.*

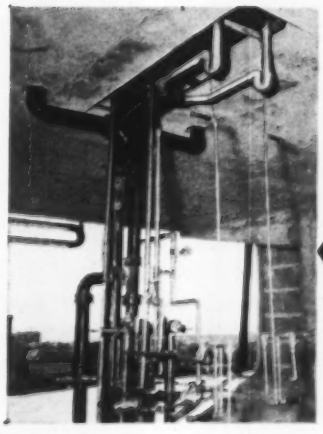
▸ *BALANCING VALVE* — Newly revised, 4 page bulletin describes "Equatemp" balancing valves for regulating water flow in piping of heating and cooling systems. Bulletin gives features of screwed and solder end valves in text and illustrations. *Ohio Brass Co., Dept. HPAC, 380 N. Main St., Mansfield, Ohio.*

▸ *COMBUSTION SYSTEM* — Illustrated, 4 page bulletin "No. 185A" describes company's "Thermopak" line of industrial and commercial boilers. Installations, specifications,

Ease of Prefabricating
REVERE COPPER WATER TUBE
a big factor in proving copper costs less than rustable material to install



REVERE COPPER WATER TUBE lends itself ideally to sub-assemblies like these. Except for the vent stack the three sub-assemblies shown make up the complete roughing-in for an entire bathroom. Solder fittings assured tight joints when handled and installed. Installation time was saved. Tube supplied by Revere Distributor, CRANE COMPANY, Dallas, Texas.



CHILLED WATER CIRCULATING SYSTEM of Revere Copper Water Tube showing expansion loops and risers which are carried out through the entire periphery of the building. All tube will eventually be insulated as shown. Note absence of joints when easy-to-bend Revere Copper Water Tube is used. It would have been necessary to cut 8 threads and make 8 fittings, in this one set of loops alone, had rustable pipe been used here.

PHOTO SHOWS a complete roughing-in of two abutting baths, together with copper drainage lines from the two bathtubs in the bathroom above. Easier fabrication, less space requirements and the non-rusting qualities of copper are the reasons for using this material for these drainage lines on this job.

THE STATLER HILTON HOTEL
Dallas, Texas

IN this newest Dallas hotel there were 60,000 lbs. of Revere Copper Water Tube in diameters ranging from ⅜" to 2½" used for hot and cold water plumbing lines and chilled water lines for air conditioning.

A most interesting feature of this installation was the various sub-assemblies used. (See upper left photo) According to Mr. Brown of the BROWN-OLDS COMPANY, mechanical contractors on the job, "The prefabrication of the sub-assemblies saved many hours of installation time, thus making a copper job cost less than rustable materials to install. But that's only *one* reason we prefer copper water tube. Not only is time saved with the solder fittings used, but you can work in the tight spots without worrying about wrench space. You are always sure of tight joints, and sub-assemblies can't work loose in handling. Then, of course, there is never any corrosion problem, so we always feel confident of doing a good job when we use copper water tube."

These same outstanding characteristics of Revere Copper Water Tube also make it the preferred material for radiant panel heating, underground service lines, drainage, waste and vent lines, oil burner and processing lines.

REVERE COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
230 Park Avenue, New York 17, N. Y.

COPPER * BRASS * 18 01 * REVERE * ALUMINUM

Mills: Rome, N. Y.; Baltimore, Md.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Brooklyn, N. Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities, Distributors Everywhere.

YOU CAN *Profit* BY THE USE OF THESE *Practical* PRODUCTS OF GOODALL ENGINEERING . . .

Rubber EXPANSION JOINTS

Custom-built to meet specific requirements in sizes from ⅜" I.D. to 96" I.D., for pressures up to 125 lbs. P.S.I. and/or vacuum. Available in Right Angle Sleeve Types and "Flang-Lok"; single or multiple arch; tapered; offset; and rectangular.

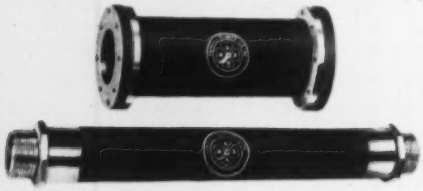
LONGER SERVICE LIFE. No deterioration through embrittlement or corrosion.

SENSITIVE RESPONSE TO PRESSURE. Only slightest pressure required to create movement in the joint, in any direction. Stress on metal pipe or other connected member reduced to absolute minimum.

EASIER TO INSTALL. Light in weight . . . short face-to-face dimensions . . . retaining rings or flanges quickly aligned and bolted. No gaskets required.

Rubber VIBRATION —SOUND ABSORBER UNITS

Economical for use in many installations in place of expansion joints, for effective control of vibration and noise emanating from water pipes, air conditioning, heating and ventilating equipment. Strong, durable, resilient rubber compound, with wear and weather-resistant cover. Plain or with built-in wire reinforcement. Furnished with I.P.T. ferrules or steel split connecting flanges. Sizes ½" to 12" I.D., in lengths from 12" to 48".



"Rubberhide" LININGS FOR CORROSION CONTROL

"RUBBERHIDE" Linings are compounded to assure long-lasting protection against the particular corrosive agents involved. They will repay many times their cost through extended life of products, parts or equipment. Produced with either rubber or neoprene as the base material. Processed to objects shipped to our Linings Plants in Trenton, Chicago or Houston; or, when the objects are too large for such shipment, or the work involves fixed plant equipment, experienced field crews do the processing "on location".

"If it's GOODALL, it MUST be Good!"

Contact Our Nearest Branch or Write for Catalog

Standard of Quality—Since 1870 HOSE · BELTING · FOOTWEAR · CLOTHING AND OTHER INDUSTRIAL RUBBER PRODUCTS

GOODALL *Rubber Company*

GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.

BRANCHES AND DISTRIBUTORS THROUGHOUT THE UNITED STATES. IN CANADA: GOODALL RUBBER CO. OF CANADA LTD., TORONTO.

RECENT TRADE LITERATURE

Continued

features all discussed in publication. Illustrated with photos, charts, diagrams. *Preferred Utilities Mfg. Corp., Dept. HPAC, 1860 Broadway, New York 23.*

▸ *DAMPER* — Data sheet "DC-9" gives details on "Roto-Link" opposed and parallel blade dampers. Following features cited: torque requirements reduced, made uniform; narrower blades may be used; greater free area; back lash eliminated. Sheet illustrated with drawings, charts. *American Foundry & Furnace Co., Dept. HPAC, Washington St. at McClun, Bloomington, Ill.*

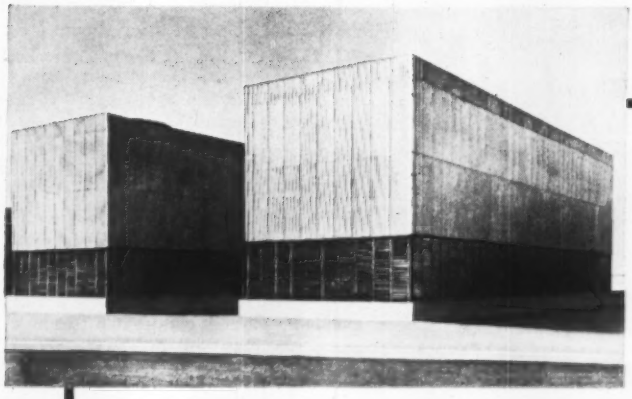
▸ *DRAFT CONTROL* — Specifications, information on draft controls for boilers in industrial and commercial heating, processing application given in company's illustrated publication. Two models described in detail: "M + MG2" and "MG1." Booklet illustrated with photos, drawings; specifications given in charts. *Field Control Div., H. D. Conkey & Co., Dept. HPAC, Mendota, Ill.*

▸ *EXPANSION JOINTS* — New 80 page catalog covers company's line of "S-R" expansion joints. Includes complete information for rating joints subjected to axial or lateral movement, angular rotation or combinations of these movements, together with formulas, tables for calculating forces, bending movements developed in connected piping or equipment. Table of dimensions, weights for expansion joints 3 to 72 in. also included. *Badger Mfg. Co., Dept. HPAC, 230 Bent St., Cambridge, Mass.*

▸ *FAN HOUSINGS*—Features, specifications of manufacturer's line of sheet metal fan housings given in 4 page bulletin "H-58." Tables give suitable dimensions for each of company's standard wheel diameters. *Revcor, Inc., Dept. HPAC, 251 Edwards St., Carpentersville, Ill.*

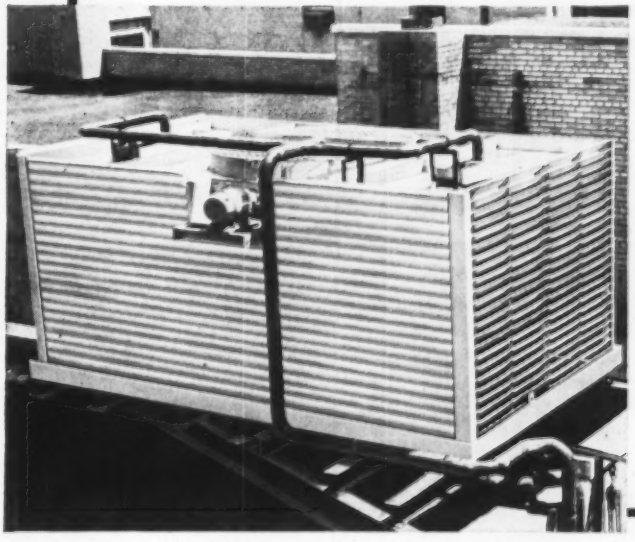
HEADQUARTERS FOR COOLING TOWERS

150 TONS and UP



Tower on left is redwood framed Type WT with cement asbestos casing and louvers. Type WT towers are available from 500 tons and up.

Counterflow Type Towers available with either redwood or steel framing. Steel framing members are all hot dipped galvanized after fabrication in accordance with ASTM specifications. Partitions, louvers and siding of cement asbestos board are standard on this type of tower.



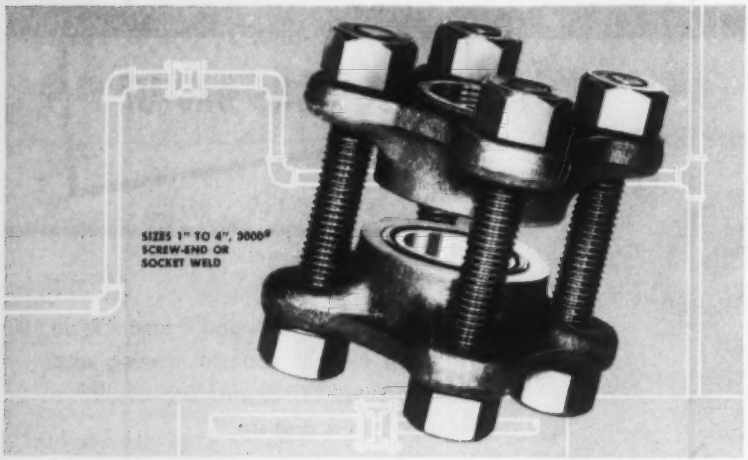
Series "DA" towers are available in California redwood, or Hot Dipped Galvanized framing. Corrugated cement asbestos board casing, laid horizontally, is fastened to frame with Galvanized bolts and Neoprene washers. Slipfit louvers of flat cement asbestos board provide easy access. All hardware is Hot Dipped Galvanized.

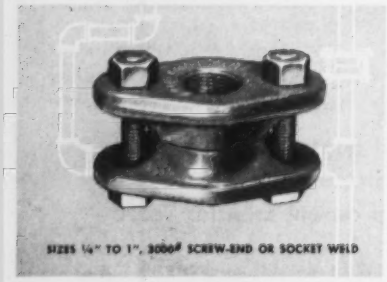
SPECIAL FEATURES ON ALL TOWERS

Corrosion Resistant Hardware. Aluminum or Stainless Steel Fans. Nailless Redwood Filling Removable at Tower Base. Nailless Three-Pass Redwood Eliminators. Removable Louvers.

Phillips Cooling Tower Co., Inc.
220 DUPONT ST., BROOKLYN 22, N. Y.

W-S The double diamond assures double value




SIZES ¼" TO 1", 3000# SCREW-END OR SOCKET WELD

SIZES 1½" TO 3", 6000# SCREW-END OR SOCKET WELD

Installation flexibility with permanent piping strength

GET BOTH WITH W-S O-RING FLANGE UNIONS

NOW, you can install high pressure piping systems that can easily be rearranged and adapted with full assurance that the unions will give the leak-proof service of permanent installations. This is made possible by these adaptable features of W-S O-Ring Flange Unions:

- Available in 2-bolt and 4-bolt types, according to size.
- Available in Screw-end and Socket Welding Types—3000# and 6000#.
- Sizes ¼" to 1" in 2-bolt 3000#; sizes 1" to 4" in 4-bolt type 3000#; sizes ½" to 3" in 4-bolt type only 6000#.
- O-Rings available in a variety of materials for a wide range of service.

Specify forged steel W-S O-Ring Flange Unions for a tight seal against fluid pressure in piping for hydraulic machinery, refrigeration piping, steam and water lines, process liquid and gas lines, and many other applications.

For full specifications, write for Bulletin U-1-58

W-S manufactures a full range of high quality drop forged fittings, unions and couplets . . . in carbon, stainless and alloy steels. For full information about these products, or for your specification forging requirements, write to: W-S Fittings Works, H. K. Porter Company, Inc., Box 95, Roselle, N. J.

H. K. PORTER COMPANY, INC.

FORGE AND FITTINGS DIVISION

W-S Fittings Works, Roselle, N. J. • Cleveland Forge Works, Cleveland 4, Ohio
Stainless Steel Works, Duncannon, Pa.

RECENT TRADE LITERATURE

Continued

▸ *FAN INLET RINGS* — Data sheet "1-58" gives specifications for company's line of fan inlet rings. Specifications for rings for use with "Blastaire" and "Type R" wheels given in chart form. *Revcor, Inc., Dept. HPAC, 251 Edwards St., Carpentersville, Ill.*

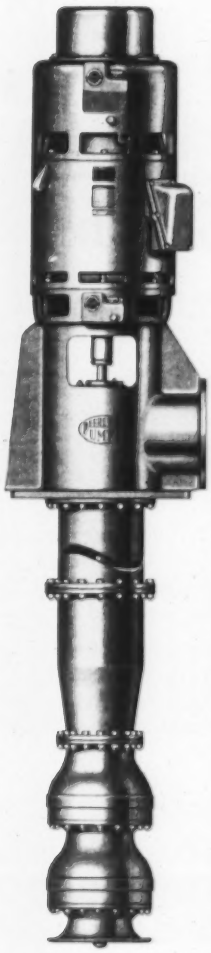
▸ *FLEXIBLE TUBING* —"The World of Mr. Flexon," illustrated booklet recently released by manufacturer, shows wide range of applications possible with flexible tubing. Booklet is illustrated with job photographs, showing company's products at work. *Flexonics Corp., Dept. HPAC, 1391 S. Third Ave., Maywood, Ill.*

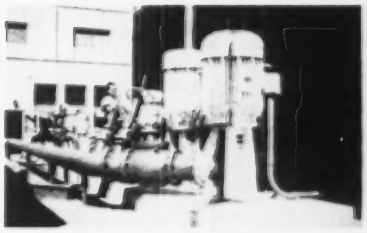
▸ *FLUXES* — Illustrated 20 page "Complete Flux Issue" of company's "Technical Information Digest TIS 2839" explains three functions of flux: removal of surface oxides; protection of molten filler metal; minimization and control of welding heat input. *Eutectic Welding Alloys., Dept. HPAC, 40-40 172nd St., Flushing 58, N. Y.*

▸ *GAS FIRED BOILER* — Product bulletin "JR-10-1G" describes "R-Z-U Junior" gas fired boiler units. Available in 11 sizes, boilers range from 427,000 to 1,928,000 Btu per hr gross output. *Fitzgibbons Boiler Co., Inc., Dept. HPAC, 101 Park Ave., New York 17.*

▸ *HEAT EXCHANGER TUBING* — Reprint of technical paper "TR-559" explains factors involved in selection of proper heat exchanger tubing for refinery and petrochemical service in 11 illustrated pages. Article includes tables showing properties of different types of tubing steels employed in such service. *Babcock & Wilcox Co., Dept. HPAC, Beaver Falls, Pa.*

▸ *HEAT GAIN CALCULATOR* — Heat gain values of various glass glaz-





mark of distinction

As the Northwest Indians told their story with totem poles, Peerless Pump dramatizes theirs in terms of outstanding performance. An example is the Peerless vertical industrial service pump. Versatile and economical, these pumps offer excellent head-capacity characteristics, plus other measurable advantages such as: *advanced vertical turbine design* for peak efficiency, *designed-in flexibility* for adaptation to future system requirements, *vertical pump-motor design* for maximum utilization of floor space. Available in water and process liquid handling types, the Peerless vertical industrial service pump can be applied to all installations where liquids are to be transferred from short settings.

WRITE FOR BULLETIN NO. B-505

PEERLESS PUMPS

Putting Ideas to Work

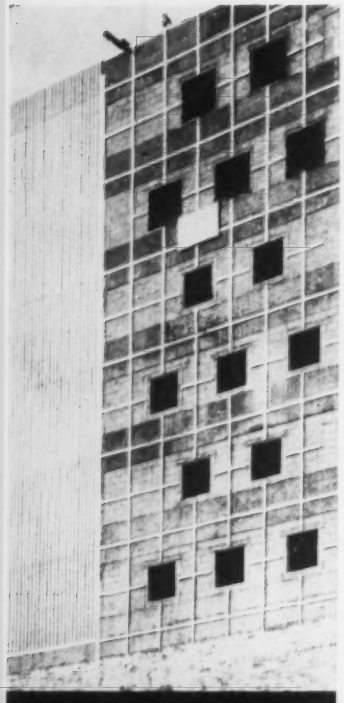
fmc FOOD MACHINERY AND CHEMICAL CORPORATION ®

FOOD MACHINERY AND CHEMICAL CORPORATION

Peerless Pump Division

Plants: LOS ANGELES 31, CALIFORNIA and INDIANAPOLIS 8, INDIANA

Offices: New York; Cleveland; Chicago; St. Louis; San Francisco; Atlanta; Plainview; Lubbock; Phoenix; Albuquerque; Los Angeles; Fresno. **Distributors in Principal Cities.** Consult your telephone directory.



HIT THE DOUBLE JACKPOT!

Save 40% in time, labor, materials with Ramset and Shure-Set!

That's what a Baltimore contractor saved . . . 40%. That's the kind of saving you can expect when you use—

RAMSET for heavy-duty fastening to steel and solid concrete . . . SHURE-SET for light fastening to masonry and concrete block!

You get the lowest in-place cost without drilling, bolting or plugging. No power lines, no bulky equipment. You increase your profit two ways on *every* job!

Ramset®

Powder-actuated RAMSET is up to 15 times faster than old-style fastening methods. Completely portable. Every RAMSET fastener is 100% guaranteed, and it's Austempered for high hardness combined with maximum toughness.

Shure-Set®

SHURE-SET drives like a nail, holds like an anchor . . . uses every ounce of power behind every hammer blow. Uses no cartridge. Sets pins faster, more securely—without bending or breaking . . . right through light-gauge metal.

Ask your RAMSET dealer to supply both tools. Look under "Tools" in the yellow pages, or write for free booklet *today!*

OLIN MATHIESON CHEMICAL CORPORATION — Ramset

Ramset Fastening System

WINCHESTER-WESTERN DIVISION

OLIN MATHIESON CHEMICAL CORPORATION

12109-I Berea Road • Cleveland 11, Ohio

RECENT TRADE LITERATURE

Continued

ings determined with calculator available from glass manufacturer. Device works on slide principle, quickly gives calculations. *Libbey-Owens-Ford Glass Co., Dept. HPAC, 608 Madison Ave., Toledo 3, Ohio.*

▸ *HIGH-PRESSURE AIR UNITS* — Engineering data sheet "HCD" covers hot, cold air handling equipment available for the "HCD-5" model. Features cited: dual forward curved fans with adjustable diffusers; internal vibration isolation of fans and motors; total high-pressure construction; option of horizontal or angular discharge. Capacities are from 5000 to 25,000 cfm, up to 8 in. water gage. *Drayer-Hanson, Div. of National-U. S. Radiator Corp., Dept. HPAC, 3301 Medford St., Los Angeles 63.*

▸ *HIGH PRESSURE SEALING* — Catalog covers line of high pressure sealing devices soon to be in production. Included are "Hexseals," for electrical switches and rotating shafts, as well as screws, rivets, bolts using same principle. *Metal Process Co., Dept. HPAC, 1811 First Ave., New York 28.*

▸ *HIGH VELOCITY SYSTEMS* — "High Velocity Dual Duct Systems for Multi-Zone Installations" is title of 24 page reference bulletin prepared by N. S. Shataloff on design, layout, installation of systems, giving details, illustrations, diagrams, etc. First section covers details for rectangular high pressure ducts with design procedures; second section gives basic schemes of air distribution systems, dual duct air handling apparatus, costs, control, operation, construction, specifications. *Buensod-Stacey, Inc., Dept. HPAC, 45 W. 18th St., New York 11.*

▸ *INDIRECT FIRED HEATERS* — New, 8 page brochure reports on how to heat almost any gas, vapor or liquid efficiently, economically, with company's "Type 102" heater. Pho-

Marsh Valves

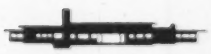
. . . signpost of dependability all along the NEW YORK THRUWAY

Williamsville Toll Interchange, New York Thruway

Over 5000 Marsh Fig. 1139 and 1239 re-enforced, packless, graduated valves are delivering maximum dependable service for 63 separate hot water systems on the 427 miles of modern super-highway from New York to Buffalo. Marsh Valves were chosen for this job because of their dependability, competitive price and profit-protecting freedom from call-backs.

Every single one of the Marsh Valves used on this state-spanning highway was alloy cast, precision machined and 100% pressure tested under the same rigid product control standards that characterize all Marsh of Dunkirk products. With anything less than superior Marsh quality, 63 separate potential call back headaches might eat away profits. However, the competitively low-priced Marsh Valves will protect this profit for years to come.

Always be sure to specify and order dependable, quality valves by Marsh of Dunkirk for remodeling installations as well as new building contracts.



SERVICE AREAS —
Architect: Eggers and Higgins
Consulting Engineers:
Jaros, Baum & Bolles
Heating Contractors:
Joseph Davis, Inc
Mechanical Installations, Inc
Harry Hoyle Contracting Co.

TOLL INTERCHANGES —
Mechanical Engineers:
Syska & Hennessy, Inc
Heating Contractor:
Mechanical Installations, Inc

Write for full details on the complete Marsh Line

Marsh Valve COMPANY
OF DUNKIRK, NEW YORK, U.S.A.

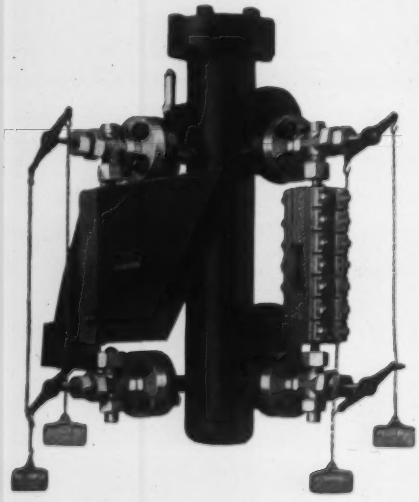
Manufacturers of Quality Valves Since 1910

Reliance Boiler Safety Equipment is a profitable investment for your power plant

Don't overlook the relatively *small* equipment that keeps the *big* equipment running smoothly. Reliance Safety Devices are mainly applied to boiler water level supervision, but the well-being of your boilers affects other "big" equipment, as you know. So the selection of high grade accessories for the boilers is of major importance.

Water Columns and Gages are basic equipment you must add to your boiler when installed, or order with it from your boiler maker. Reliance offers you complete service in approved devices for water level supervision, including extra alarm devices that help insure attention of operators if a dangerous water level situation threatens. Reliance representatives in all major cities are ready to help you at any time.

The Reliance Gauge Column Company
5902 Carnegie Ave., Cleveland 3, Ohio



Water Columns for all pressures, with or without alarms.

Water Gage Valves

Gage (try) Cocks

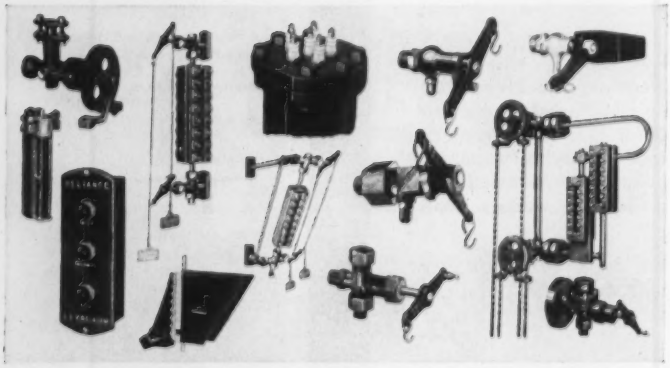
Gage Inserts

Direct-to-Drum Gage Assemblies

Water Gage Illuminators

EYE-HYE Remote Reading Water Level Indicator

Float-type and Electrode-type Liquid Level Alarm Devices



The name that introduced safety water columns....in 1884

Reliance®

BOILER SAFETY DEVICES

RECENT TRADE LITERATURE
Continued

tos show many typical applications; cut-away drawings show unit operation. *Brown Fintube Co., Dept. HPAC, Elyria, Ohio.*

▸ *INDUCTION HEATING* — Folder "DM-74" describes 400 cycle induction heating generator, tells applications in preheating, stress relieving of arc welded piping joints. Generator operated by "Elektronik Strip Chart Program Controller." Planned program of preheating, soaking, cooling automatically controlled and permanent record of every phase recorded on strip chart. *Hobart Brothers Co., Dept. HPAC, Hobart Sq., Troy* 1, *Ohio.*

▸ *INDUSTRIAL VALVES* — Bulletin "159" covers industrial bronze valve line for industrial, government specification, commercial, original equipment specification. Gate and globe valves in various pressure classifications described with additional items. *Hammond Brass Works, Dept. HPAC,* 1844 *Summer Blvd., Hammond, Ind.*

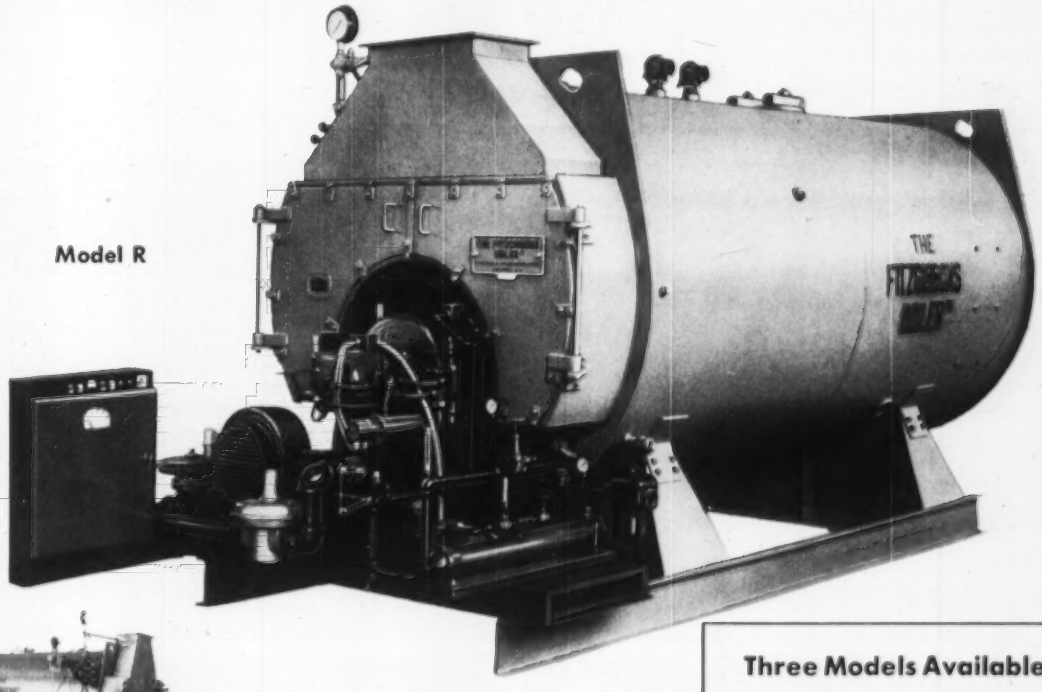
▸ *INSULATIONS* — Illustrated thermal insulation chart helps in determining thermal values for heat-flow: up, down and lateral; in ceilings, walls and floors; winter and summer. Thermal values of nonmetallic and metallic insulations may be compared and interchanged with respect to various factors, thicknesses, types. *Infra Insulation Inc., Dept. HPAC,* 525 *Broadway, New York* 12.

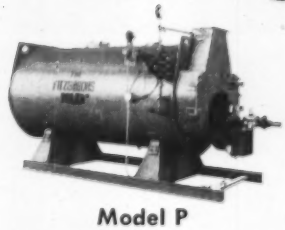
▸ *LMTD CHART* — Chart developed for determining logarithmic mean temperature difference using simple three-column operation. By connecting initial temperature difference in left hand column with final temperature difference in right hand column, logarithmic mean temperature difference reached at intersection in middle column. *Dean Thermo-Panel Coil Div., Dean Products, Inc., Dept. HPAC,* 616 *Franklin Ave., Brooklyn* 38.

NEW PACKAGED BOILERS

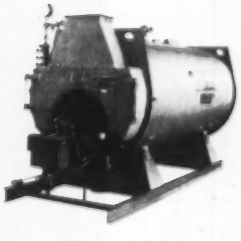
For steam and hot water heating and hot water supply for schools, institutions, apartments, hotels, factories, offices and all modern buildings.

Model R

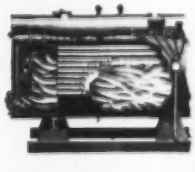




Model P



Model PB



Full Wet Back Design

These three new series of Forced Draft Packaged Boiler-Burner Units represent the result of over 72 years of boiler design and manufacturing experience. They incorporate many distinctive and exclusive features that assure economical, low cost, low maintenance operation.

These Scotch-Type Boilers feature full fillet welded butt heads for added strength; a pressurized, gasketed smokebox with side hinged, gas-tight doors for ease of access for care and maintenance; A.S.M.E. Code (or better) construction; and The Fitzgibbons-Developed "Full Wet Back and Sides" design which completely surrounds the rear combustion chambers with circulating water for higher efficiency, plus the elimination of rear refractory and its expensive maintenance.

The burners are the quality product of a nationally known company and are excellently designed, easily serviced and field supported by an extensive service organization.

The unit is fire tested at the Fitzgibbons Plant to insure optimum performance and a certificate is issued detailing the test results. Certified efficiency of the boiler is over 80%. The unit is ready for installation when shipped. **Write today for full catalog material on these most modern packaged units.**

Three Models Available

MODEL R
59-464 H.P. Horizontal Rotary, Oil-Oil/Gas-Gas

MODEL P
59-93 H.P. Pressure Atomizing, Light Oil-Oil/Gas-Gas

MODEL PB
59-93 H.P. Pressure Atomizing, Oil Only—Through #5

Fitzgibbons Boiler Company, Inc.

New York Sales and Executive Office
101 PARK AVE., NEW YORK 17, N. Y.

Field Sales Office and Plant
OSWEGO, NEW YORK

Branches and Representatives in Principal Cities
Dept. 20

FB-136

100 percent air recirculation? you're crazy!

Total recirculation isn't the answer in every case but it gives the best purity and the lowest cost for many ventilating situations. The point is, Barnebey-Cheney activated charcoal air purification *lets you design for total recirculation* of inside air, and save substantially in both initial investment for heating and cooling equipment and operating costs.

A typical well designed system uses outside air in the spring and fall for cooling and 100% recirculation with activated charcoal purification in the summer and winter. In most buildings normal infiltration and the opening of doors provides plenty of oxygen. Pressurizing of the building can be incorporated if desired. Write for Bulletin T-321. Barnebey-Cheney, Columbus 19, Ohio.

activated charcoal air purification

Barnebey Cheney

RECENT TRADE LITERATURE

Continued

▸ *MOBILE COMPRESSOR* — New catalog "DS-361A" describes lightweight aluminum reciprocating compressor for mobile air conditioning systems. "Model C-563" compressor is three-cylinder, 2 × 2 in. (bore and stroke) refrigeration unit with 5 ton capacity at 40 F suction, 110 F condensing temperature with refrigerant 12 at 1800 rpm. *Trane Co., Dept. HPAC, La Crosse, Wis.*

▸ *MOTORIZED VALVES* — Specifications of magnetic, motorized valves for use with air, water, gas, steam, oil, refrigerants listed, illustrated in 24 page catalog "V-58." Also included are solenoid coil rating tables, liquid and compressible fluid flow charts. Dimensional drawings also given. *Mercoid Corp., Dept. HPAC,* 4201 *Belmont Ave., Chicago* 41.

▸ *ODOR CONTROL* — Illustrated, 4 page brochure covers company's work in odor control research, engineering. Nature of problem and methods developed by company to solve it are discussed. *Hemeon Associates, Air Pollution Research Engineers, Dept. HPAC,* 121 *Meyran Ave., Pittsburgh* 13.

▸ *PACKAGED AIR CONDITIONER* — Complete specifications, construction data on new line of self-contained, air cooled air conditioners given in bulletin "2800." Five models in new line include two 2 hp units, two 3 hp units, one 4 hp unit with capacities 19,700 to 40,000 Btu per hr. *Ilg Electric Ventilating Co., Dept. HPAC,* 2850 *N. Pulaski Rd., Chicago* 41, *Ill.*

▸ *PIPE FITTINGS* — Recently released, illustrated, 8 page catalog gives data, details on ductile iron pipe fittings. Publication, designated "2-PF," gives types, sizes, specifications of entire line with results of performance tests. *Kuhns Brothers Co., Dept. HPAC,* 1300 *McCall St., Dayton* 2, *Ohio.*

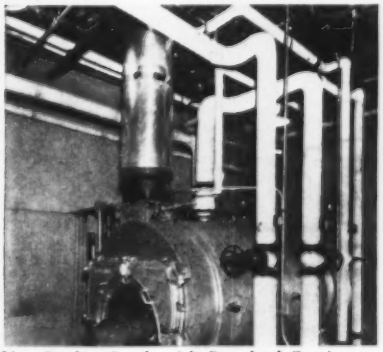
Low cost refractory stack outlasts steel

Low cost — The Van-Packer Industrial Stack is made of prefabricated sections for economy and easy installation. It costs no more than a steel stack, yet lasts substantially longer. Costs only a third as much as a brick stack.

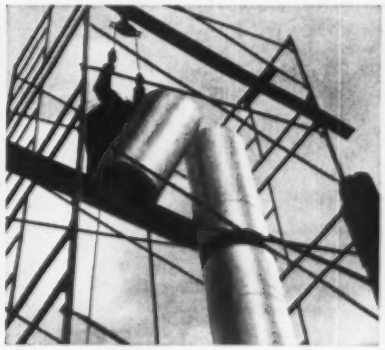
Refractory construction — Van-Packer Stack sections are centrifugally-cast of refractory material that will not corrode. Three-foot long sections come in 7 diameters from 10-inch ID to 30-inch ID to meet your requirements.

Needs no maintenance — Sections of the Van-Packer Stack are cemented one on top of another with acidproof cement, and secured with aluminum drawbands. Sections have an aluminum outer jacket that requires no maintenance.

Available nationwide — The Van-Packer Stack is available through local Van-Packer Jobbers and Special Representatives. See "Chimneys — Prefabricated" in Yellow Pages, or write Van-Packer for Bulletin LS-52-57.



Van-Packer Stack with Standard Sections handles boilers and furnaces efficiently. Can be superimposed or floor supported.



Installing this stack is quick and easy. Three-foot sections are simply cemented atop one another with acidproof cement.

Van-Packer Stack with Hi-Temp Sections handles industrial incinerators with flue gas temperatures up to 2000° F.

Van-Packer PREFABRICATED REFRACTORY **Stack**

Van-Packer Company • Division of the Flintkote Company
P. O. Box No. 306, Bettendorf, Iowa • Phone: East Moline, Ill. 3-5288

Sweet's

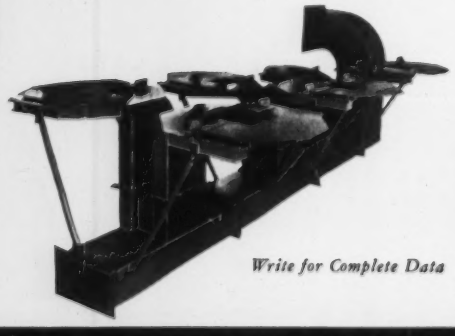
Van-Cor

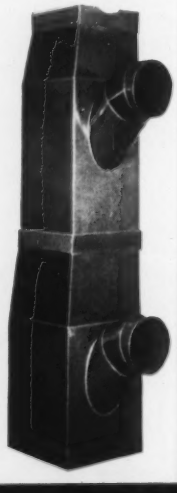
90 and H Joining Strips

Revolutionary Method of Connecting PVC Sheet Stock — Van-Cor 90 and H joining strips use solvent welding to obtain maximum joint efficiency. They save time and money compared with hot air welding. Skilled welders are unnecessary—your own men can fabricate readily. On major installations using these Van-Cor strips, job costs have been cut over 30%!

Two Shapes—Three Sizes—Use 90 degree joining strips for making corners, H strips in a single plane. They handle sheet in ⅛", 3/16" and ¼" gauges. Both shapes available in Van-Cor 1 (normal impact) and Van-Cor 2 (high impact). Standard strip length is 10 feet.

For flanges and stiffeners of fabricated sections, extruded structural angles in 10 foot lengths are available in sizes 1½" x 1½" x 3/16" and 2" x 2" x ¼".





Write for Complete Data

INDUSTRIAL DIVISION OF...

COLONIAL PLASTICS MFG. CO.

Subsidiary of THE VAN DORN IRON WORKS CO.

2685 EAST 79TH STREET CLEVELAND 4, OHIO

RECENT TRADE LITERATURE

Continued

▸ *PIPE ROTATORS* — New 4 page bulletin describes two new pipe rotator models. The first is the "Peck Jr." model for pipe up to 5 in. diam, a portable unit suitable for field applications. Second rotator is heavy-duty model for pipe up to 36 in. diam in shop fabrication applications. *Cecil C. Peck Co., Dept. HPAC,* 14900 *Woodworth Rd., Cleveland* 10.

▸ *PUMPS, VALVES* — Recently published 12 page catalog "No. 100" contains basic information on company's line of pumps, fluid motors, valves. Description of operating principles, internal constructions, specification charts, diagrams, photos included in publication. *Tuthill Pump Co., Dept. HPAC,* 939 *E. 95th St., Chicago* 19.

▸ *POWER ROOF EXHAUSTER* — New, 6 page brochure available with information, including performance, dimensional data, on line of "Super Air-Van" reinforced glass fiber power roof exhausters. *Gallaher Co., Dept. HPAC,* 4108 *Dodge St., Omaha* 31.

▸ *PRESSURE-VACUUM CONTROLS* — "Condensed Catalog 500" is 8 page catalog with specifications, descriptive data on variety of pressure-vacuum control. Catalog contains over 190 standard types, models, classified for reference. Essential specifications given in charts. *United Electric Controls Co., Dept. HPAC,* 79 *School St., Watertown, Mass.*

▸ *RADIANT BASEBOARD* — New catalog describes company's products with special sections devoted to company's new "BFOT" baseboard line and "BE 10" and "BE 12" lines. Complete engineering information, specifications given with photos, cutaway drawings, diagrams, charts, etc. *Dunham-Bush, Inc., Dept. HPAC,* 179 *South St., West Hartford* 10, *Conn.*

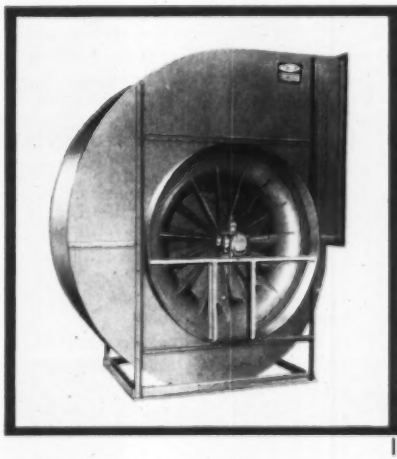
NEW additions to the No. 1 air conditioning line

Carrier

Centrifugal Fans

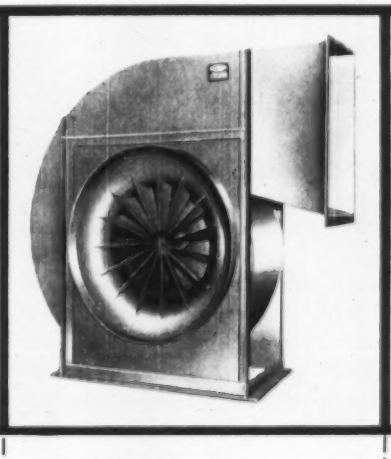
These new Carrier Centrifugal Fans are designed to meet the specific needs of a wide variety of comfort and industrial air conditioning applications. Built to the highest standards of quality, they assure long years of superior performance on any application. When teamed with Carrier's famous refrigeration and air conditioning components, they can satisfy the exact requirements of any commercial or industrial building. For their specific applications, see the thumbnail descriptions given below.

Complete facts in practical new easy-to-use catalog
Carrier's new Centrifugal Fan Catalog contains complete information about all three fans. 96 pages. Contents include mechanical specifications, general specifications, general engineering data and capacity rating tables. Catalog provides complete selection data for practically all applications without reference to other data books. To obtain your free copy, call your nearest Carrier office. Or write to Carrier Corporation, Syracuse 1, New York.



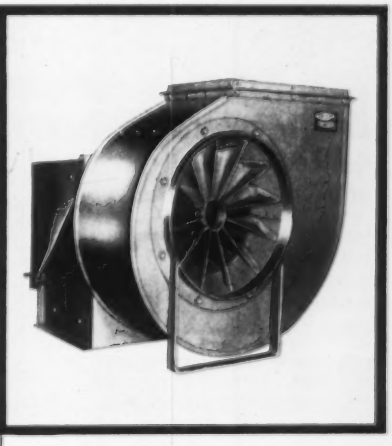
27CN Multi-purpose

For all conventional and medium high-pressure air conditioning systems. Class I and II construction. Twenty-one sizes. Capacities from 700 cfm to more than 250,000 cfm. Single and double inlet types. Fixed inlet vanes standard on all but four smallest sizes. Variable vanes available among accessories.



27CH Heavy-duty

For modern high-pressure air conditioning systems. Class II and III construction. Available in thirteen sizes. Capacities range from 4000 cfm to over 100,000 cfm. Single and double inlet types. Fixed inlet vanes standard on all sizes. Variable vanes available among complete line of accessories.



27CV Packaged

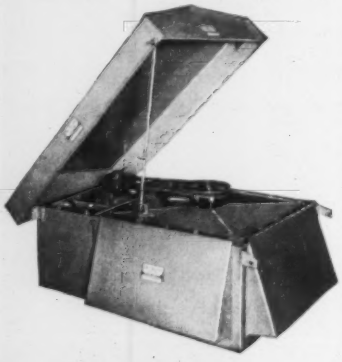
For any low-pressure ventilating service. Package consists of fan, motor, adjustable motor mount and V-belt drive assembled for quick, easy installation. Single inlet type only. Nine sizes from 100 cfm to 20,000 cfm. Fixed inlet vanes standard on all but smallest size. Extra-quiet operation.

AirMpeler

LO-BOY

CENTRIFUGAL ROOF EXHAUSTERS

Enhance the Beauty of Building Skylines



Pats. Pend.

Lowest Silhouette Design

Forward or Backward Curve Wheel Within . . . . or Out of Scroll Housing

Motor mounting on side of structure support . . . out of line of air stream reduces height of Lo-Boy models nearly 50% of older designs.

LOW WIND RESISTANCE
SIZES 10"-72" 600-47,000
CERTIFIED C.F.M. RATINGS

- **QUALITY** • **BEAUTY**
- **PROVEN PERFORMANCE**

See Sweet's File 20c/Amm or Write for bulletin HA-100 58

AMMERMAN CO., INC.

110 North Second St.
Minneapolis 1, Minnesota
MEMBER OF THE AIR MOVING & CONDITIONING ASSN.

RECENT TRADE LITERATURE

Continued

▸ *REFLECTIVE INSULATION* — Four new types of aluminum foil reflective insulation described in new brochure prepared for those professionally interested in insulation field. Data provided on thermal efficiency, uses, methods of application of "Alfol" types "44," "44F," "22," "22F." *Reflectal Corp., Dept. HPAC, 200 S. Michigan Ave., Chicago 4.*

▸ *SCAFFOLD TOWERS* — Bulletin "No. 66" explains various applications of scaffold used as rolling towers and work staging for all types of interior, exterior maintenance, repair work. Publication illustrated with application photos, construction diagrams. *Beaver-Advance Corp., Dept. HPAC, Ellwood City, Pa.*

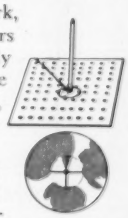
▸ *SEALING DUCT INSULATION* — Folder titled, "Durable Seal for Duct Insulation Joints," gives suggestions for making neat, permanent seals on all types of duct insulation joints. Diagrams, installation photos shows application of company's "Dutch Brand Pressure Sensitive Waterproof Cloth Tape" in forming, holding, sealing air duct insulation used in heating, ventilation, air conditioning. *Dutch Brand Div. of Johns-Manville, Dept. HPAC, 7800 S. Woodlawn Ave., Chicago 19.*

▸ *SEPARATORS* — "Hi-Line" separators for steam, gas, air and vapor phase chemicals described, illustrated in new data sheet. Developed to eliminate entrainment from vapor and process lines, separators are installed directly in operating line either horizontal or vertical upward. Diagrams, charts give dimensional and specification data. *A. C. S. Industrial Div., American Copper Sponge Co., Inc., Dept. HPAC, 71 Villanova St., Woonsocket, R. I.*

▸ *SILVER-JOINING ALLOYS* — Illustrated 24 page "Silver Alloy Issue" of company's "Technical Information Digest" provides technical

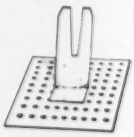
SAVE TIME— SAVE MONEY
with these dependable INSULATION HANGERS

GEMCO
Spindle Hangers and W-A Self-Locking Washers



Ideal for insulation work, Gemco Spindle Hangers are easily and quickly installed . . . with positive adhesion to concrete, brick or metal. W-A Self-Locking Washers pressed over spindles with minimum effort and lock insulation securely in place.

GEMCO Pronged Hangers



Designed especially for supporting various types of block insulation. Easily applied for positive adhesion. Prongs (available in various lengths from 1 3/16" to 6 7/8") bend over to hold insulation firmly in place.

TUFF-WELD Nylon Hangers

Two-piece hangers . . . with bases of tough, mold nylon and spindles of metal. Made especially for smooth surfaces. Spindles snapped into bases as needed; reduces inventory, storage space, freight costs. W-A Self-locking washers hold insulation securely in place.

TUFF-BOND Quik-Set Adhesive (for smooth or slightly irregular surfaces) and General Purpose Adhesive (for rougher surfaces) assure permanent adhesion of hangers when used as directed. Write or wire for details and specifications.

GOODLOE E. MOORE
INCORPORATED
DANVILLE 28, ILLINOIS

FICTION and FACT

FICTION:

Removal of odors from the air requires bulky, expensive equipment—necessitating larger fans and motors to overcome resistance

FACT:

R P Super Filter Coat, applied to R P Aluminum Filters, automatically removes both dust and odors, with no other equipment required.

RP

Multi-Velocity Industrial AIR FILTERS

When you specify R P Industrial Filters, you gain the tremendous advantage of inexpensive, automatic odor-removal through the use of R P Super Filter Coat water soluble adhesive. Odors are actually removed from the air stream by absorption, held by the adhesive, and prevented from re-circulating. It is *NOT* a simple masking process—it's true, positive odor-removal. Through the reduction in make-up air requirements possible with this true odor removal, reductions in the size of heating and cooling equipment and in operating costs are available. And this important odor-removing function is, of course, a plus feature—in addition to effective dust removing properties and the like-new efficiency restored to the filter after washing and re-coating.

Permanent-type light weight, rugged, aluminum R P Industrial Filters have other advantages too. Their light weight makes them easier to handle and wash; eliminated heavy structural design in filter bank construction; reduces operating and maintenance costs through longer service life and easier handling. Write for complete information on the benefits of R P Industrial Air Filters.

RP *Products of Research*

RESEARCH PRODUCTS *Corporation*

Dept. 46, Madison 10, Wisconsin

PANELBLOC GAS-FIRED HEATERS ARE SAFE AND DEPENDABLE

THEY'RE FAST BECOMING AMERICA'S MOST POPULAR GAS HEATER

If you don't know the full story on PANELBLOC, you should write for information today.

Panelbloc heaters are manufactured for stock, and are shipped upon receipt of order. Installation and start up is fast —no electrical connections or expensive wiring needed. There are no fans or blowers—no moving parts. That means no noise, and minimum maintenance.

Panelbloc can heat an entire area, or any portion of that area — and no partitions are needed. Panelbloc actually "Heats Like The Sun".

Mail coupon today!

Thermobloc Division
PRAT-DANIEL CORPORATION
8-9 Meadow St. So. Norwalk, Conn.

☐ Please rush literature on Panelbloc
☐ Have representative call

Name_____

Title_____

(PLEASE attach coupon to your Company Letterhead)

RECENT TRADE LITERATURE

Continued

data for production and maintenance of high grade silver alloys for metal-joining. Heating techniques, including torch, furnace, induction, other methods included with problems such as tool tipping, precision production work, etc. *Eutectic Welding Alloys Corp.*, 40-40 172*nd St.*, *Flushing* 58, *N. Y.*

▸ *SOLUTION METERING* — Nomograph available to determine ideal capacities for controlled volume pump and chemical holding tank in few seconds. Originally prepared by company as an aid to its own sales engineers. *Milton Roy Co., Dept. HPAC*, 1300 *E. Mermaid Lane, Philadelphia* 18.

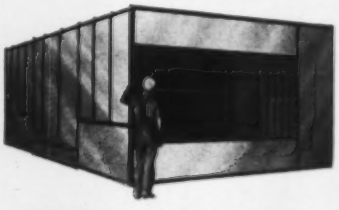
▸ *STEAM GENERATOR* — New, 20 page catalog gives data on manufacturer's line of equipment, featuring "VLP" package 2-drum water walled steam generator. Publication is illustrated with photos, diagrams, drawings. *Erie City Iron Works, Dept. HPAC*, 1450 *East Ave., Erie, Pa.*

▸ *THERMOCOUPLE ASSEMBLIES* — New, 12 page catalog "Section E" covers heavy industrial thermocouple assemblies in manufacturer's line. Each component comprising complete assembly individually described. Assemblies cover temperatures −300 to 2200 F. Illustrated, diagrammed. *Thermo Electric Co., Dept. HPAC, Saddle Brook, N. J.*

▸ *UNIT HEATER* — New, 4 page catalog "No. 287" illustrates, describes new line of five "Luxaire" direct fired gas unit heaters. Publication describes design refinements, construction, provides complete ratings, specifications, dimensions. *C. A. Olsen Mfg. Co., Dept. HPAC, Elyria, Ohio.*

▸ *UNIT HEATERS* — Bulletin details new line of automatic gas-fired unit heaters in 8 pages. Gives com-

CAPILLARY ® Air Washers



ARTICULATED UNITS

LOUVRE DAMPERS

A&R

PRODUCTS
For Air Conditioning
Write for catalog
To —
AIR & REFRIGERATION CORPORATION
439 MADISON AVENUE
NEW YORK 22, N. Y.

®TRADEMARK REG.

RECENT TRADE LITERATURE

Continued

plete specifications on 10 new units ranging 25,000 to 250,000 Btu per hr. *Ilg Electric Ventilating Co., Dept. HPAC, 2850 N. Pulaski Rd., Chicago 41.*

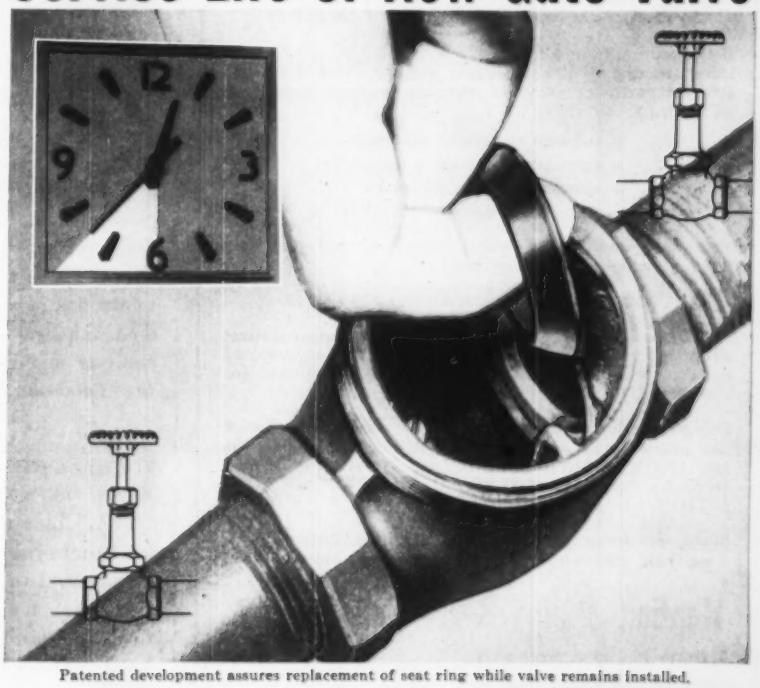
▸ *UNIT VENTILATOR* — Company's line of ventilators is covered in 28 page product bulletin "600-A1". Publication features "Draft-Stop" system to control window downdrafts with detailed information on unit's component parts. Photos, dimension and application drawings, specification data all included. *American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8.*

▸ *VACUUM PUMPS* — New, 8 page, illustrated bulletin presents manufacturer's line of "VCA" and "VCM" vacuum pumps. Applications, installation information, operation, specifications all given in bulletin "S 152." *Domestic Pump & Mfg. Corp., Dept. HPAC, Shippensburg, Pa.*

▸ *VALVES, FITTINGS* — Newly issued, 16 page book illustrates, describes company's manufacturing facilities, quality control procedures for production of high alloy commercial castings, valves, fittings. Publication gives background of information in foundry practice, capabilities from engineering and pattern making to melting, inspection, testing procedures. *Cooper Alloy Corp., Dept. HPAC, Bloy St. and Ramsey Ave., Hillside, N. J.*

▸ *VARIABLE SPEED CONTROL* — Revised, 8 page brochure "F-1882" deals with operation, application of "Varitrol" variable speed drive and pneumatic control systems. Appearing for the first time are the company's new pre-engineered instrumentation packages. Illustrated, full-color brochure shows how speeds may be set, maintained with pneumatic system, variable speed units. *U. S. Electrical Motors, Dept. HPAC, P. O. Box 2058 Terminal Annex, Los Angeles.*

Only 7 to 10 Minutes to Renew Service Life of New Gate Valve



Patented development assures replacement of seat ring while valve remains installed.

Without removing the valve body from the line, you replace the nickel-alloy seat rings in Fairbanks new patented Renewable Seat Ring Gate Valves. In 7 to 10 minutes, from the time the line is shut down until it is put back into operation, you have given a new service life, a new life of dependable tight closure to your valve.

Just 7 to 10 minutes of your maintenance man's time — only 7 to 10 minutes of "downtime" on your steam, water or process piping lines — and you have the equivalent of a new valve in the line. Think of the savings: where once at least one hour, under the most ideal conditions, was required to replace a gate valve in the line, the job is now accomplished in from 7 to 10 minutes.

Field tested for over two years, under all conditions from steam to corrosive liquids, the revolutionary new Fairbanks Renewable Seat Ring Bronze Gate Valve has proven completely satisfactory — absolutely dependable.

Made with either rising stem or non-rising stem construction in ½", ¾", 1", 1¼", 1½" and 2" sizes, the Fairbanks Renewable Seat Ring Bronze Gate Valves are recommended for severe service conditions on 200 lb. steam pressure at 550 degrees F., 400 lb. water, oil or gas pressure — non-shock — lines requiring full flow and subject to frequent operation. Nickel alloy seat rings and wedge make the valves particularly tough and corrosion resistant.

YOURS ON REQUEST: Illustrated, descriptive folder gives complete information on Fairbanks Renewable Seat Ring Gate Valve with details and specifications. Yours without charge. Write today.

1. Union Bonnet removed. Retaining screw loosened with ordinary screwdriver.

2. Finger hooks inside nickel alloy seat ring. Seat ring lifts out of valve body.

3. New seat ring is inserted. Retaining screw tightened. Bonnet replaced.

THE **Fairbanks** COMPANY
393 Lafayette Street, New York 3, N. Y.
Branches:
New York 3 • Boston 10 • Pittsburgh 22 • Rome, Ga.
Valves • Trucks • Casters • Wheels • Dart & "PIC" Unions

NOW is the time to consider

SNOW MELTING

Systems around Buildings and Grounds

Better send at once for our SNOW MELTING MANUAL. Here are design data based on a study of—and others' actual experience with over 100 snow melting systems of all kinds for

- LOADING PLATFORMS and DOCKS
- SIDEWALKS • ROADS • DRIVEWAYS
- MARQUEES • PARKING AREAS
- RUNWAYS • RAILWAY SWITCHES

and other applications which HAVE proved that this modern method of snow removal.

Costs No More Than Other Methods

—and because snow melting by pipe coils has other distinct advantages, such as dirt-free sidewalks and entrances, and the complete elimination of ice surfaces, the demand for this method of snow removal is swiftly growing.

Complete information on the correct design, installation and operation of snow melting systems is offered in the new SNOW MELTING MANUAL, a reprint of articles originally published in HEATING, PIPING & AIR CONDITIONING. Fifty cents per copy.

$0.50 will bring you this SNOW MELTING MANUAL . . . a valuable addition to your file on business opportunities.

Heating, Piping & Air Conditioning

6 North Michigan Avenue — Chicago 2, Illinois

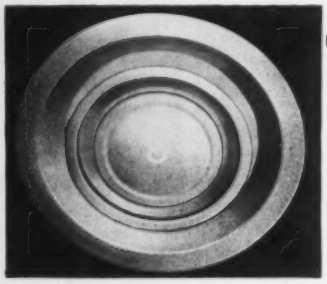
RECENT TRADE LITERATURE

Continued

▶ *WASTES TREATMENT* — Application engineering data sheet "D-58-1" describes continuous cyanide and chrome wastes treatment systems. Flow diagrams in 4 page brochure explain methods, equipment used to meter necessary chemicals automatically. *Milton Roy Co., Dept. HPAC,* 1300 *E. Mermaid Lane, Philadelphia* 18.

▶ *WATER CONDITIONING* — Fifth edition of company's handbook on industrial water conditioning recently published containing detailed technical information on basic water treatment processes. Applications, limitations of various water-treatment equipment covered. Supplementary section devoted to water control analyses and interpretation. Price of book is $3.00. *Betz Laboratories, Inc., Dept. HPAC, Philadelphia* 21.

▶ *WATER CONTROL VALVES* — Nine different valves and uses are described in 8 page bulletin "G-5A." Line includes cushioned check valves, water level control valves, sensitive pressure regulators, one-man control valves in sizes from 2 to 36 in., pressures to 250 psi. Both angle, globe body patterns available. *Golden-Anderson Valve Specialty Co., Dept. HPAC,* 1210 *Ridge Ave., Pittsburgh* 33.



ALL ALUMINUM DIFFUSER

WITH ADJUSTABLE PATTERN

Silentair

SUMS UP YOUR AIR DISTRIBUTION NEEDS!

WHAT'S NEW ABOUT THIS DIFFUSER!

1 All aluminum construction.

2 Internal vanes for segmental air pattern adjustment, which is stable in intermediate angles — ceiling or duct mounted.

3 Choice of air movement control from any one or combination of diffuser quadrants.

4 Choice of conditioned zone temperature and humidity control variations as required . . . independently in any one, or combination of four regions served by a single diffuser.

THESE ARE YOUR BENEFITS!

► 1 No corrosion problem.

► 2 Identical and harmonious outward appearance for fixed (CF), adjustable (CA) or combination supply-return (CR) diffusers.

► 3 In "comfort" applications . . . satisfies the "outdoor" type as well as the "sheltered" individual in choice of air movement.

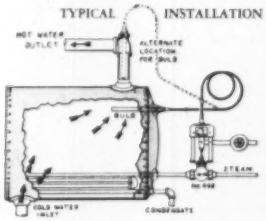
► 4 Simplifies air balancing for comfort or industrial applications by permitting quick, positive temperature and humidity control by putting air where it's needed.

COMPLETE ENGINEERING DATA AVAILABLE . . . WRITE FOR SILENTAIR BULLETIN C-100

GENERAL AIR PRODUCTS CORP.

14-40 FACTORY STREET • CEDAR GROVE, NEW JERSEY

If you need to control
tank temperature



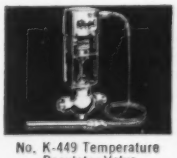
call for a valve from

Klipfel

Klipfel Temperature Regulator Valves operate without auxiliary power. Pressure changes in a temperature-sensitive bulb are transmitted to a seamless, 2-ply, extra-strong bellows which opens or closes the valve smoothly to maintain desired temperature.

Wide Temperature Range **Indestructible Yoke**
Direct or reverse action **Manual override**
Single, double or three-way bodies

Call your supply house or write for Bulletin 354-A.


No. K-449 Temperature Regulator Valve

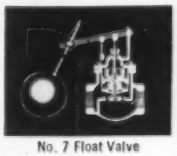
No. K-348 Temperature Regulator Valve

AIR MAIL
Most items shipped within 24 hours after order is received

No. 410 Reducing Valve

No. 300 Reducing Valve

No. 135 Relief Valve


No. 7 Float Valve

No. 27 Float Valve

No. 135 Multiport Relief Valve

HAMILTON • OHIO **Klipfel** VALVES INC.

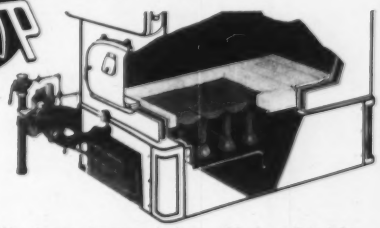
Automatic Temperature-and-Pressure-Regulating Valves Since 1902

Float Valves • Temperature Regulators • Back Pressure Valves • Reducing Valves

A DIVISION OF THE HAMILTON-THOMAS CORPORATION

*"Planned Performance"**

BURNERS

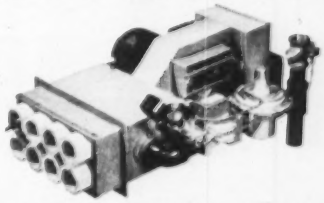


For heating and power boilers. 23 sizes listed in Catalog No. A-10.

BLUE LINE UPSHOT ATMOSPHERIC GAS BURNER

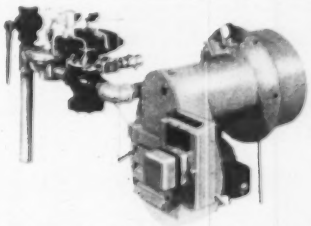
Retracted oil nozzle on gas firing. Sizes up to 30 GPH light oil. Catalog E-30.

DUO-FLAME COMBINATION GAS-OIL BURNER



Fully automatic, forced draft. Sizes listed to 28 million BTU/HR in Catalog C-10.

TURBO-FIRE POWER TYPE GAS BURNER



No stack required on boilers equipped for pressure firing. Sizes up to 10 million BTU/HR in Catalog C-15.

SCOTCH MARINE TYPE FGR PRESSURE BURNER

* PLANNED — Factory assembled, pre-wired for "Bolt-in" installation.

* PERFORMANCE — Custom matched to individual boilers for quiet, efficient operation.

Gordon & Piatt also manufacturer of a complete line of domestic conversion burners plus large dual-fuel units. Write for literature and complete information.

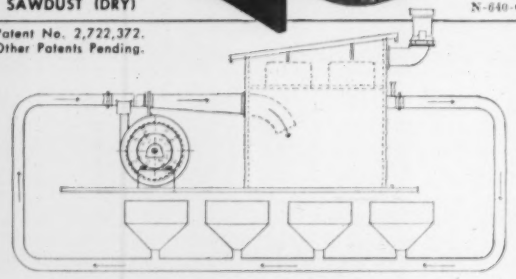
Gordon & Piatt
P. O. Box 914
Winfield, Kansas

NOW... ANY MATERIAL THAT CAN BE MOVED BY AIR CAN BE MOVED BY *Quickdraft!*

CEMENT, SAND, IRON OXIDE, WHEAT, CORN, SALT, LIMESTONE (PULV.), CASTOR BEANS, KNOTS, BLOCKS, PAPER, WOOL, COTTON, OATS, RAGS, RUBBER, VEGETABLES (PULV. DRY), COAL (POWDERED), SHAVINGS, CORK (GROUND), SAWDUST (DRY)

N-640-QD

Patent No. 2,722,372.
Other Patents Pending.



TYPICAL EXAMPLE — Q-8 Stainless Steel Quickdraft Materials Handling Unit 77" long, 60 HP 3,450 RPM motor, high-pressure turbo blower, exhausting into 13 x 15 x 15 storage room, pulling through 400 ft. of open 8" pipe. Negative static pressure readings taken 7 diameters back of Quickdraft — 17.6" WG, velocity 11,676 FPM pulling 135 ft. . . . 18.6" WG, velocity 9,306 FPM pulling 270 ft. . . . 19.3" WG, velocity 6,074 FPM pulling 400 ft.

NEW HEAVY-DUTY HIGH-PRESSURE EXHAUSTERS MOVE BULK MATERIALS QUICKLY, EFFICIENTLY, ECONOMICALLY

Bulk materials are moved without downtime for replacing fan blades, motors or bearings . . . with high pressure Quickdraft Materials Handling Units. Open or closed systems can be used. Quickdraft is also ideal for exhausting paint spray, abrasives, corrosive gases, noxious fumes and high temperatures. Models range from 6 to 30-inches in diameter. For engineering data on high-pressure Quickdraft Units for materials handling . . . heavy duty models for industrial exhausting . . . standard models for heating-plant venting . . . *write today!*

IMPORTANT NOTICE

For withstanding corrosive gases all Quickdraft units are available in standard acid resisting vitreous enamel, No. 316 Stainless Steel, rigid plastics (PVC), and with plastic and Fiberglas coatings

NO MOTORS, FANS OR BEARINGS IN EXHAUST LINE!

Quickdraft CORPORATION

P. O. Box 87-K
Canton 1, Ohio

WHO'S WHAT...

(New personnel, promotions)

▸ *RADIANT-RAY RADIATION, INC.*—Fred W. Becher, president.

▸ *SKIL CORP.*—John Spaulding, president.

▸ *UNIVERSAL INSULATING MACHINE CO.*—L. A. Dermyer, president.

▸ *DRAVO CORP.*—William D. Bickel, elected to board of directors.

▸ *ARMCO STEEL CORP.*—L. T. Johnston, executive vice president—sales; W. B. Quail, vice president in charge of steel sales in Armco Div.; W. S. Newell, vice president in charge of steel sales in Sheffield Div.; C. W. Rowles, controller; G. E. Humphrey and E. A. Rickling, assistant controllers; D. C. Boone, controller for Armco Div.; L. H. Juengling, vice president and coordinator of general purchasing and traffic activities; J. S. Thomas, general director of purchases; R. F. Kuhnlein, vice president—Sheffield operations, succeeding Mr. Juengling; R. C. Rhoades, works manager—Kansas City; E. H. Thorsteinson, assistant to the president; Gordon R. Graham, controller of National Supply Div.; C. W. Beck, director of purchases for the Armco Div.

▸ *DRYOMATIC CORP.*—Purcell Smith, financial vice president.

▸ *WALTON LABORATORIES, INC.*—J. Robert Lewis, vice president in charge of engineered sales.

▸ *VULCAN RADIATOR CO.*—James W. Cira, director of engineering, design and new product development.

▸ *POWER FLAME DIV., INC.*—Earl C. Thompson, chief engineer in charge of program for new development.

▸ *MINNEAPOLIS-HONEYWELL REGULATOR CO.*—George M. Muschamp, vice president—engineering; O. B. Wilson, group vice president—marketing; John M. Wilson, director of engineering; R. L. Mallory, sales manager of the industrial products group; J. A. Robinson, sales manager of Brown Instruments Div.; Howard J. MacDonald, general manager of valve division; H. Earl Benson, sales manager for Rubicon Div.

HELP US KEEP THE THINGS WORTH KEEPING

Gently, he starts her on another adventure in a wonder-filled world.

Will her world always be so peaceful, so free? You can help it be—by helping to keep the peace.

But peace costs money. Money for strength to keep the peace. Money for science and education to help make peace lasting. And money saved by individuals.

Your Savings Bonds, as a direct investment in your country, make you a Partner in strengthening America's Peace Power.

The chart below shows how the Bonds you buy will earn money for you. But the most important thing they earn is *peace*. They help us keep the things worth keeping.

Think it over. Are you buying as many Bonds as you *might*?

Photograph by Harold Halma

HOW YOU CAN REACH YOUR SAVINGS GOAL WITH U. S. SAVINGS BONDS *(in just 8 years, 11 months)*			
If you want about	$2,500	$5,000	$10,000
each week, save	$4.75	$9.50	$18.75

This shows only a few examples. You can save any sum, buying Bonds by Payroll Savings or where you bank. Start your program now!

HELP STRENGTHEN AMERICA'S PEACE POWER

BUY U. S. SAVINGS BONDS

The U.S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, The Advertising Council and this magazine.

WHO'S WHAT

Continued

▸ *EKCO PRODUCTS CO.*—Malcom N. Smith, vice president of product planning.

▸ *CRANE CO.*—David H. McClain, general manager of company's branches; William B. Gilmour, general manager of merchandising; Darrell R. Nordwall, general manager of sales.

▸ *JOSEPH T. RYERSON & SON, INC.*—Paul J. Fountain, manager of stainless steel sales; Phillip B. Van Horne, consultant, stainless sales.

▸ *E. I. duPONT de NEMOURS & CO. INC.*—Charles H. Topping, senior architectural and civil consultant, re-elected president of Building Research Institute.

▸ *AMERICAN-STANDARD*—Robert W. Hawkins, supervisor of training services for Plumbing and Heating Div.

▸ *ALLIED CHEMICAL*—Fred C. Hitchings, sales manager for refrigerants and aerosol propellants produced by General Chemical Div.; Lee D. Callans, manager of division's market surveys department.

▸ *KEASBEY & MATTISON CO.*—Joseph R. Rohrer, credit manager.

▸ *MAUREY MFG. CORP.*—Joseph F. Taylor, assistant to the vice president.

▸ *McQUAY, INC.*—Edward J. Pottner, assistant treasurer.

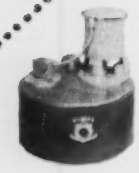
▸ *OAKITE PRODUCTS, INC.*—William A. Baltzell, industrial sales manager.

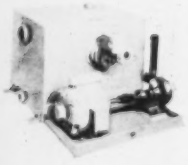
▸ *SPORLAN VALVE CO.*—R. E. Niedermeier, product sales manager; Jack E. Dannels, sales manager, OEM accounts.

▸ *ACME INDUSTRIES, INC.*—Robert Kuhn, sales application engineer.

▸ *H. C. LITTLE BURNER CO., INC.*—Robert A. Washburn, assistant general sales manager.

▸ *PITTSBURGH PLATE GLASS CO.*—Harry J. Paulus, manager of building products sales for the glass fiber division.

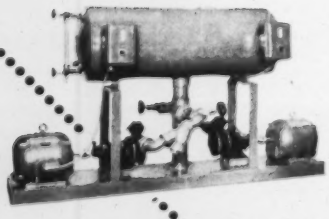




EAGAN EAGLE —For steam heating loads up to 8000 sq. ft. at 20 p.s.i. Does not require pit even though return lines are no more than one foot above the floor.

EAGAN HOT POT —Vertical submerged type pump with cast iron receiver. Motor and pump above receiver safe from flooding. Single and duplex construction. Models for loads up to 15,000 sq. ft. at 20 p.s.i.

TYPE ECIV —Vertical pump and receiver for installations where return lines are below floor levels. Single or duplex units. Models up to 10,000 sq. ft. capacity at 60 p.s.i.



TYPE EC —Straight line arrangement requiring less floor space than necessary for competitive makes. Both pumps accessible for maintenance purposes. Single and duplex models designed for 2000 to 100,000 sq. ft. discharging against pressures of from 10 to 200 p.s.i.

EAGAN...

the complete line of Condensate Return Pumps

Eagan offers a full line of Condensate Return Pumps, and also manufactures Fuel Oil Pump and Heater Sets, Proportioning Pumps, Turbine Pumps and Centrifugal Pumps.

WALTER H. EAGAN CO., INC.

Pump Specialists Since 1920

2336 Fairmount Ave., Dept. HPAC, Phila. 30, Pa.

Gentlemen:
Send me complete information on the EAGAN Line of Condensate Pumps.

COMPANY .....

NAME .....

ADDRESS .....

CITY ..... ZONE .. STATE .....

if you specify or install hot water heating systems...

...THESE P-K CATALOGS BELONG ON YOUR DESK

Water-to-water or steam-to-water convertors . . . P-K makes both in a wide range of sizes. All are engineered for high heat transfer and low maintenance. All are in quantity production for quick delivery and are competitively priced.

These catalogs will give you much useful information about P-K Convertors. If you don't already have them, just mail the coupon at right. The Patterson-Kelley Co., Inc., 2109 Warren St., East Stroudsburg, Pennsylvania.

Patterson-Kelley Co., Inc.
2109 Warren St., East Stroudsburg, Penna.
Send me the literature checked:

- ☐ Catalog 303 – P-K Convertors for Hot Water Heating Systems
- ☐ Bulletin 6050 – P-K Forced Boiler Water Heat Exchangers

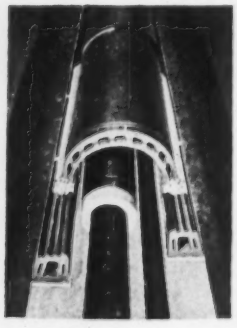
*Name*_____ *Title*_____
*Company*_____
*Address*_____
*City*_____ *Zone*____ *State*_____

Patterson Kelley
Water Heater Division

Storage Water Heaters • Instantaneous Heaters • Convertors • Fuel Oil Heaters

proven thermal efficiency!

Some idea of the high level of satisfaction to be expected from a Therm-O-Tile installation can be gained from noting the results obtained from a test conducted on an actual Therm-O-Tile conduit line: 95.7% thermal efficiency! The installation tested was a typical one, completed under contract. The test was thoroughly documented and affords interesting reading. Write for your copy of test results.



Therm-O-Tile®
conduit system
FOR UNDERGROUND PIPING

H. W. PORTER CO., INC. — NEWARK 12, NEW JERSEY
or Subsidiary
REID HAYDEN, INC. — BALTIMORE • CHARLOTTE • RICHMOND

WHO'S WHAT

Continued

▸ *O. A. SUTTON CORP., INC.*—Frank O'Malley, director of industrial relations.

▸ *VALVAIR CORP.*—Duane R. Branaka, sales manager.

▸ *SQUARE D CO.*—Robert E. King, distribution equipment sales manager.

▸ *CARRIER CORP.*—Walter H. Steitler, assistant to the president; Elbridge Gamnill, director of project qualification; William H. Macdonald, manager of the machinery department; Robert A. Reister, assistant manager of the machinery department; Jay E. Endres, manager of manufacturing engineering department.

▸ *BLACK & DECKER MFG. CO.*—Carl McWade and and Harry L. Williamson, Jr., product planning and development.

▸ *DRYER ELECTRIC CORP.*—R. H. Kieth, application engineering consultant.

▸ *YORK CORP.*—Christian J. Schurman, general sales manager.

▸ *ARMSTRONG CORK CO.*—Albert G. Matamoros, general manager of new office of economic and marketing research; William J. Watkins, manager of marketing research; Gray Playter, manager of advertising research; Warren J. Wittreich, marketing research psychologist.

▸ *STERLING, INC.*—Paul D. Kelly, assistant sales manager.

▸ *THERMOBLOC DIV. of PRAT-DANIEL CORP.*—Joseph W. Adams, assistant manager.

▸ *BELL & GOSSETT CO.*—Donald C. Broadwell, export manager.

▸ *CLEVELAND HEATER CO.*—Leonard Gold, advertising manager.

▸ *WALWORTH CO.*—Dr. J. F. Dunn, assistant director of research.

▸ *BRYANT MFG. CO.*—Joseph A. Mekel, manager of technical service and application department.

☆ ☆ ☆

Manufacturers' Agents

Are you interested in securing additional lines?

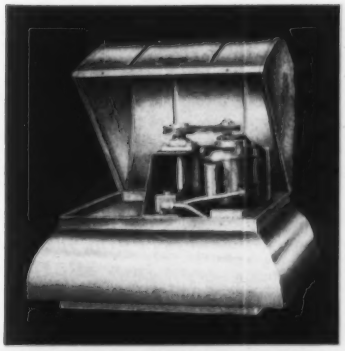
We are occasionally asked by our manufacturer advertisers to suggest the names of manufacturers' agents in various sections of the country whom they can contact in regard to representation of their industrial and large building heating, piping, and air conditioning products.

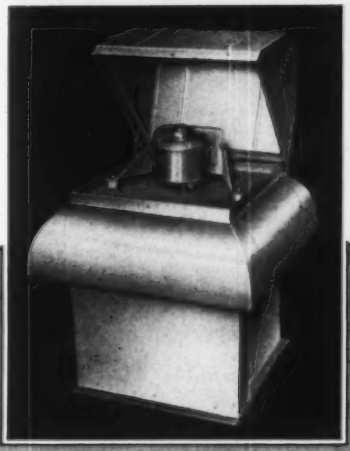
If you would like your name listed on our records for inquiries we may receive on your territory, we invite you to write us. There is no charge in connection with this service.

Heating, Piping & Air Conditioning

6 NORTH MICHIGAN AVENUE
CHICAGO 2 ILLINOIS

☆ ☆ ☆





Aladdin
AIR HANDLING EQUIPMENT

ROOF VENTILATORS

- **THIRTEEN SIZES**
- **SELF CONTAINED**
- **QUIET OPERATING**

ALADDIN Type V Roof Ventilators are available in a complete range of sizes... direct and belt driven. Units can be furnished in both curb mounted or extended base types. Ruggedly built, the type V units have been designed for those installations where positive year around powered ventilation is required, and when properly installed, will give years of efficient trouble free service.

Write for complete data

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA

WHO'S WHAT

Continued

▸ *BALDWIN-HILL CO.*—Harold L. Humes, vice president, re-elected vice president of Building Research Institute.

▸ *SUN-RAY BURNER MFG. CO.*—G. M. Marin, president, elected vice president of Oil Heat Institute of America.

▸ *EDDINGTON METAL SPECIALTY CO.*—Stanley Czarnecki, president, elected vice president of Oil Heat Institute of America.

▸ *AMERICAN GAS ASSOCIATION*—J. Theodore Wolfe, president of Baltimore Gas and Electric Co., nominated for president; Wister H. Ligon, president of Nashville Gas Co., nominated for first vice president; L. T. Potter, president of Lone Star Gas Co., nominated for second vice president; Vincent T. Miles, treasurer of Long Island Lighting Co., nominated treasurer.

▸ *BABCOCK & WILCOX CO.*—F. Stan Romanse, assistant general purchasing agent, elected president of Purchasing Agents Association of New York, Inc.

▸ *COPELAND REFRIGERATION CORP.*—B. W. Moreland, general manager of manufacturing.

▸ *SKAGGS-WALSH, INC.*—Fred Heaney, president, elected vice president of Oil Heat Institute of America.

▸ *INDUSTRIAL COMBUSTION, INC.*—J. Verne Resek, president, re-elected president of Oil Heat Institute of America.

▸ *CHASE BRASS & COPPER*—Ralph E. Herzler, Jr., aluminum specialist.

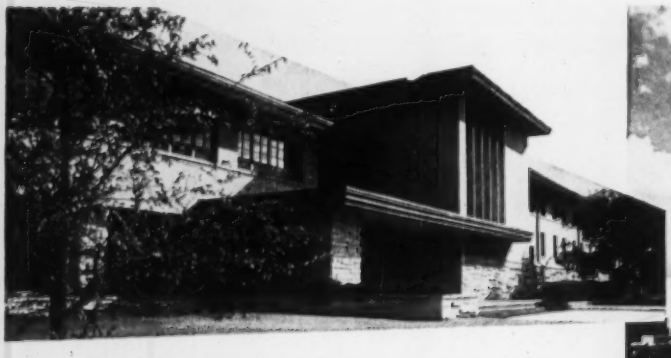
▸ *CONTROLS CO. OF AMERICA*—Jack Schnable, West Coast general sales manager.

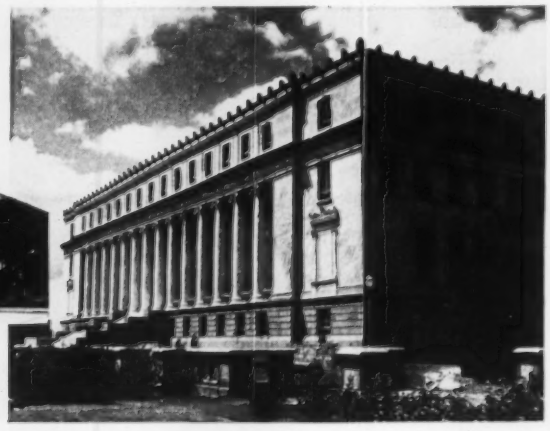
IN THE TERRITORIES . . .

(Recent sales appointments)

▸ *HUPP CORP.*—David P. Haring, regional sales manager of the southeastern states for *TYPHOON AIR CONDITIONING CO.* and *TYPHOON HEAT PUMP CO.* divisions.

▸ *CAMBRIDGE FILTER CO.*—Alfred J. Hamilton, representative for the state of Connecticut.





AT TEXAS A&M

Thermal Engineering year around central plant and multizone air conditioners are in operation in the Administration Building*, the Library*, the Memorial Student Center*, and the U. S. Dept. of Agriculture facility* at the Agricultural and Mechanical College of Texas. Many additional Thermal units are presently to be installed in the new Chemistry Building**.

*Hollis U. Bible, Consulting Engineer, Houston, Texas

**Bernard Johnson & Associates, Consulting Engineers, Houston, Texas

Thermal Engineering manufactures a complete line of central plant and multizone conditioners, sprayed coil units, heating and ventilating units, heating and cooling coils and air-cooled condensers. Write for complete information and a list of satisfied users.

Manufacturers' Agents... territories open in certain areas... write us.

Quality Products Since 1945

THERMAL ENGINEERING CORPORATION

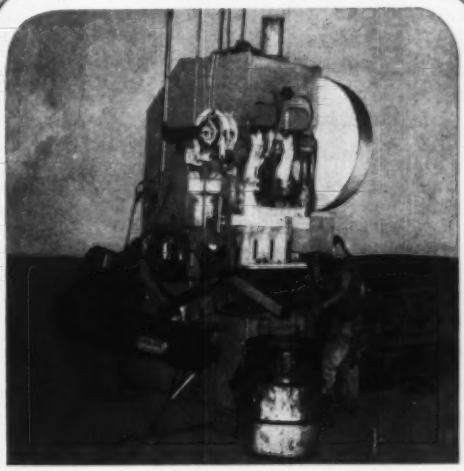
2605 W. DALLAS • P. O. BOX 13254 HOUSTON 19, TEXAS

"WITCH"

PIPE HANGERS

FOR

HEATING — PLUMBING POWER & PROCESS



The latest mass-production methods are used to manufacture uniformly high quality pipe hangers and supports at the lowest cost to the customer.

Our catalogue illustrates a complete line of Pipe Hangers & Supports and is an indispensable reference book for engineers, contractors, estimators & erectors. Write for your copy now.

MAINTAINING OFFICES AND WAREHOUSES ACROSS THE NATION

CARPENTER and PATERSON, Inc.

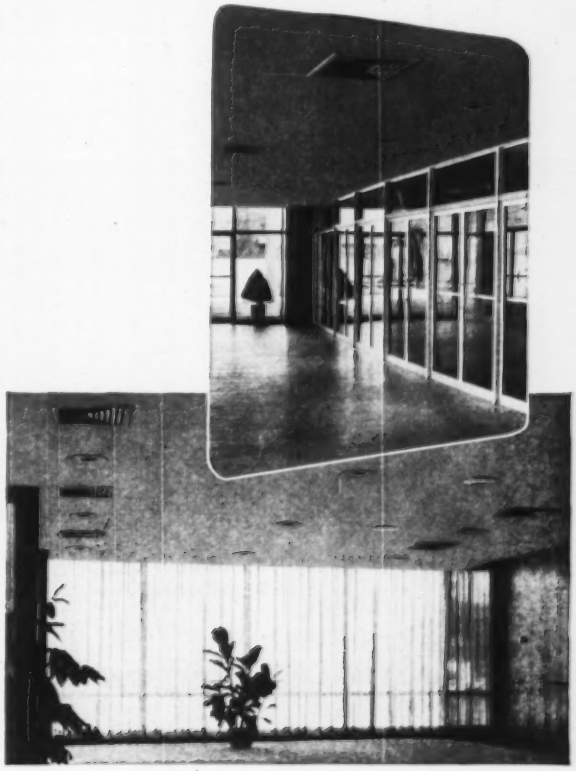
18 HURLEY ST., CAMBRIDGE, MASS.

AGITAIR®

Custom Made

SQUARE and RECTANGULAR

AIR DIFFUSERS



Custom made in unlimited air patterns, AGITAIR square and rectangular air diffusers suit all job conditions . . . blend perfectly with any interior design.

These AGITAIR diffusers need not be centrally located. They assure draftless, noiseless, equalized air distribution from any location in the ceiling or side wall.

Write for Catalog R107 for complete data.

THERMOFIN AGITAIR

high velocity units • punkah louvers
air diffusers • filters • exhausters

Sold exclusively by representatives for:

AIR DEVICES INC.

185 MADISON AVENUE, NEW YORK 16, N. Y.

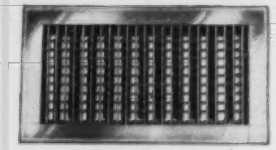
...for commercial air conditioning

THE IDEAL REGISTERS & GRILLES
For every requirement!

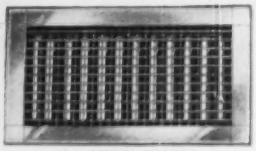
H&C

The ease with which any desired airflow, both directionally and volumetrically, can be obtained with these registers and grilles is one reason they have become exceedingly popular. The wide range covered by the quickly obtainable standard sizes is another (380 combinations). Fine appearance, excellent construction and absolutely reliable engineering data are other elements that are making this H&C line first choice of a host of air conditioning dealers for all of their commercial installations. See your H&C Jobber or write for our current Catalog "B".

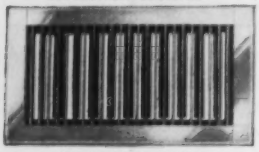
H & C TRIPL-*AIRE*® 26 STOCK SIZES PLUS "AS ORDERED"



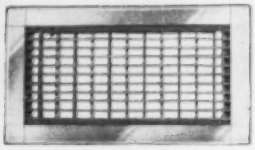
No. 92VHV DOUBLE DEFLECTION REGISTER



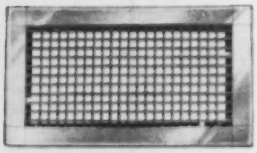
No. 92HVV DOUBLE DEFLECTION REGISTER



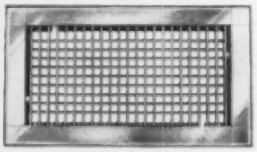
No. 92VOV SINGLE DEFLECTION REGISTER



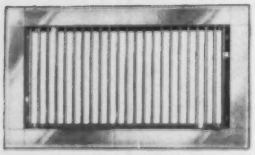
No. 92HOV SINGLE DEFLECTION REGISTER



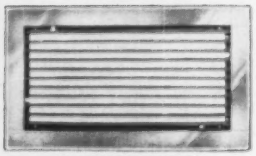
No. 92HVO DOUBLE DEFLECTION GRILLE



No. 92VHO DOUBLE DEFLECTION GRILLE

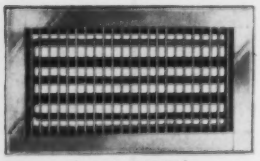


No. 92VOO SINGLE DEFLECTION GRILLE

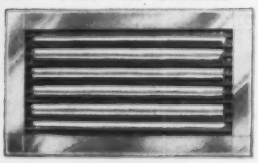


No. 92HOO SINGLE DEFLECTION GRILLE

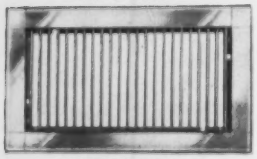
H & C FIXT-*AIRE*® 17 STOCK SIZES PLUS "AS ORDERED"



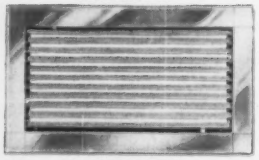
No. 93V RETURN AIR REGISTER



No. 94V RETURN AIR REGISTER



No. 93 RETURN AIR GRILLE



No. 94A RETURN AIR GRILLE

HART & COOLEY MFG. CO.
508 EAST EIGHTH ST. • HOLLAND, MICHIGAN
IN CANADA: HART & COOLEY MANUFACTURING CO., FORT ERIE, ONTARIO

WHO'S WHAT

Continued

▸ *KAM PRODUCTS CORP.* — Max Arnold Co., representative for Philadelphia and eastern Pennsylvania area.

▸ *COCHRANE CORP.* — G. M. Wallace and Co., new branch office in El Paso, Tex.

▸ *DeZURIK CORP.* — William Drummond, manager of new Philadelphia regional sales office at 118 W. King St., Malvern, Pa.

▸ *AUTOMATIC SWITCH CO.* — MG Electrical Equipment Co., Birmingham, Ala. and Dillon Supply Co., Raleigh, N. C., authorized stocking distributors.

▸ *W-K-M, Div. of ACF INDUSTRIES, INC.* — Walton L. McKinley, direct company sales representative for Florida, Alabama, Georgia, North and South Carolina, with headquarters in Jacksonville, Fla.

▸ *DRYOMATIC CORP.* — Dayrel G. Hoke, exclusive representative in Philadelphia metropolitan area.

▸ *AMERICAN-STANDARD* — George R. Dresselhouse, New York City sales manager for Plumbing and Heating Div.

▸ *CAREY ELECTRONIC ENGINEERING CO.* — Ralph L. Campbell, sales and installation engineer for Minnesota, North Dakota, South Dakota, western Wisconsin and northern Iowa.

▸ *BUENSOD-STACEY, INC.* — H. L. McMurry & Co., representative in Florida with offices in Daytona, Miami and Orlando.

▸ *FAIRBANKS CO.* — Henry H. Paris Distributor, Inc., Houston, exclusive sales agent in the states of Texas, Oklahoma and Arkansas.

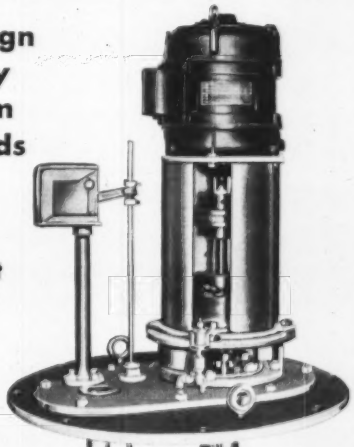
▸ *MATHES CO.* — Air Conditioning & Heat Pump Distributors, Inc., Riverside, and Southwest Supply Co., San Diego, new southern California distributors.

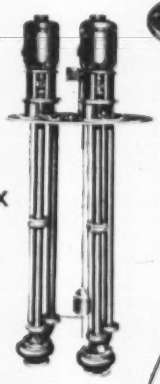
▸ *ACME INDUSTRIES, INC.* — A. G. Allen, sales engineer for Dallas area; Thomas Davenport, sales engineer for San Francisco area; Howard C. Washechek, sales engineer for Milwaukee area; T. J. Waddell, sales engineer for St. Louis area; John M. Burke, sales engineer for Kansas City area; Dean W. Duston, sales engineer for Houston area.

AMERICAN-MARSH
SEWAGE AND SUMP PUMPS

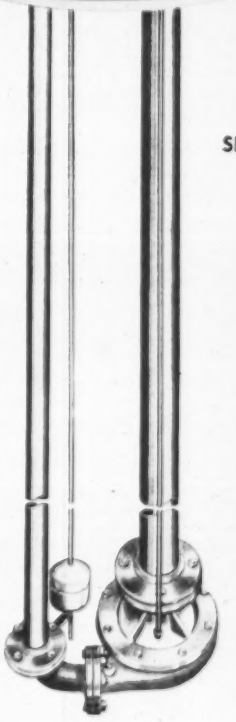
non-clog design
high efficiency
up to 800 gpm
up to 60' heads

3 types:
Vertical Wet Pit
Vertical Dry Pit
Horizontal





DUPLEX



SINGLE

SINGLE and DUPLEX
Vertical Wet Pit Pumps
Handle clear liquids or liquids with solids up to 3" diameter. Duplex has mechanical float switch alternator (optional).

Helpful "Do's and Don'ts" of pump selection given in Bulletin 325-A.

WRITE TODAY FOR YOUR COPY!

AMERICAN-MARSH PUMPS
BATTLE CREEK MICHIGAN

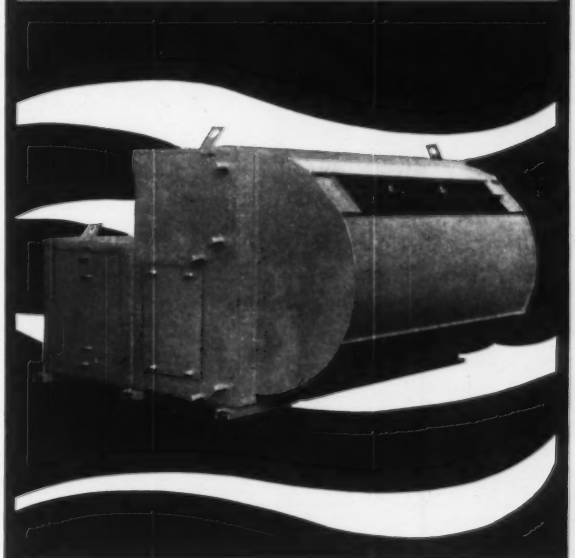
Pumps and Pumps only Since 1873

Representatives in all principal cities. See our ads in C.E.C., ASME Catalogs

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, ETC.

DRAYER HANSON
NEW "HCD"

PACE-SETTING NEW D-H HIGH PRESSURE HOT AND COLD DECK AIR HANDLING UNITS HAVE **INTERNAL VIBRATION ISOLATION!**



STANDARD MODELS 5,000 TO 25,000 CFM. UP TO 8" TOTAL STATIC PRESSURE HIGH PRESSURE CONSTRUCTION. CIRCULAR DISCHARGE PLENUM ELIMINATES BREATHING. DUAL FORWARD-CURVE FANS; BACKWARDLY-INCLINED OPTIONAL DIFFUSERS FOR EVEN AIR DISTRIBUTION. OPTION HORIZONTAL/VERTICAL DISCHARGE. PROMPT DELIVERY. MUCH MORE!

d-h SINCE 1919

drayer-hanson
DIVISION OF NATIONAL U.S. RADIATOR CORP.
3301 MEDFORD STREET
LOS ANGELES 63, CALIFORNIA
CABLE: CLINCONI LOS ANGELES

F-R ARNO DUCTAPE

Flame-Resistant Arno Ductape complies with all building codes that require the use of fire-resistant duct tape. It continues to hold firmly at temperatures of 350-400 deg. F. Even at higher temperatures, while subject to charring, it will not support flame. Of course, it meets ASTM standards.

Like all other Arno Tapes, it sticks instantly and does not dry out or lose its grip.

Seal all ducts with Arno Ductape. Use Flame-Resistant Ductape where extra fire protection is needed.

Test sample on request — specify F-R.

Sales Offices

Atlanta—2258 B Cascade Rd. S.W.
Detroit—12915 W. Eight Mile Road
Fort Worth—2724 Tillar Street
Los Angeles—3225 East 46th Street
Minneapolis—401 Plymouth Ave. North
New York—104 West 17th Street

Arno
ADHESIVE TAPES, INC.
Subsidiary of The Scholl Mfg. Co., Inc.

Arno Adhesive Tapes, Inc., 4140 Ohio Street, Michigan City, Indiana

WHO'S WHAT

Continued

▸ *FAIRMONT ALUMINUM CO.* — Caine Steel Co., St. Louis, Mo., distributor for Missouri, Kansas, Oklahoma, Texas, southern Illinois; Rolled Steel Corp., Skokie, Ill., sole distributor for parts of Michigan, Indiana, Illinois and Wisconsin.

▸ *U. S. AIR CONDITIONING CO.* — Philip R. Hedback, sales representative in Indiana.

▸ *CHELSEA FAN & BLOWER CO.* — John A. Scott Co., Los Angeles, appointed southern California territory representative.

▸ *McQUAY, INC.* — Paller Engineering Co., Indianapolis, representative.

▸ *AMERICAN AIR FILTER CO., INC.* — Joe P. Richardson, sales engineer in Minneapolis; Stanley D. Jeneen, sales engineer in Denver; Kenneth Hutchinson, sales engineer in Albany, N. Y.; Dale K. Holt, sales engineer, Los Angeles; Charles Wunderlich, sales engineer for C. H. Burnap Co., St. Louis representative; Vincent M. Quinn, sales engineer for Hucker Sales Co., Haverford, Pa. representative; William A. McKim, sales engineer for Harry G. Mouat Co., Birmingham, Ala., representative; the new address of the New York City branch office is 292 Madison Ave., New York 17.

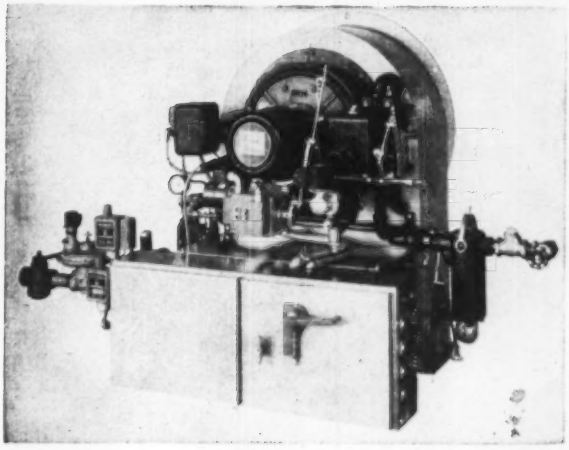
▸ *YORK CORP.* — George C. Briley, southwest district manager.

▸ *ALLIS-CHALMERS MFG. CO.* — Y. S. Hogg, manager of Tampa, Fla. district office; E. T. Cuddeback, manager of general products division sales in Southeast region; Ralph L. Haney, manager of Philadelphia district; Charles E. Dandois, manager of Allentown, Pa., district.

▸ *DUNHAM-BUSH, INC.* — John M. Haig, sales engineer in Minnesota office; William M. Jackson, representative for cooling and industrial products in Albany, N. Y. area; Nelson Co., Detroit, to handle sales and distribution in 60 mile area in and around Detroit.

▸ *FLEXONICS CORP.* — L. J. Cullen, midwestern regional sales manager, with headquarters in Maywood, Ill.; R. G. Arnold, central regional sales manager with headquarters at Inkster, Mich.; H. V. Tastrom, eastern regional sales manager at Elizabeth, N. J.; G. W. Derum, western regional sales manager at Santa Ana, Calif.

JOHNSON FORCED DRAFT PACKAGE-UNIT BURNERS



Completely Factory Assembled & Mounted

For firing with Oil only . . . Gas only . . . or combination Oil and Gas. Completely assembled and rigidly mounted at the factory ready for easy, inexpensive attachment to any boiler or heat receiver. They provide smoother, more efficient combustion regardless of stack conditions and firebox pressure variations.

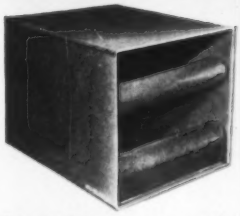
Powered by the world famous Johnson Model 53 Burners, these "packaged" units are available for any heating need, in sizes from 25HP to 500HP. If you want the last word in heating efficiency and economy, investigate these new Johnson Forced Draft Package Unit Burners.

Johnson Oil Burners

Builders of fine Oil Burner Equipment since 1903

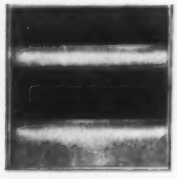
S. T. JOHNSON CO.
940 Arlington Ave., Oakland 8, Calif.
Church Road, Bridgeport, Pennsylvania

UNI-SILENCER* For AIR CONDITIONING and VENTILATING SYSTEMS

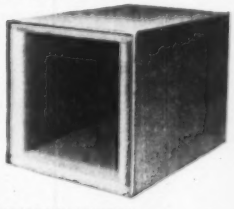


UNI-SILENCER* MODEL A
Moderate pressure drop, standard acoustical efficiency

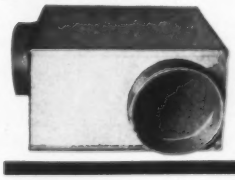
UNI-SILENCER* MODEL LPD
Lowest possible pressure drop, moderate acoustical efficiency



UNI-SILENCER* MODEL B
Higher pressure drop, maximum acoustical efficiency



UNI-RESONATOR* Low frequency duct silencer—used in series with UNI-SILENCERS*.



T. O. SILENCER
Elbow silencer for ducts

E H ROOF VENTILATOR SILENCER for power roof ventilators

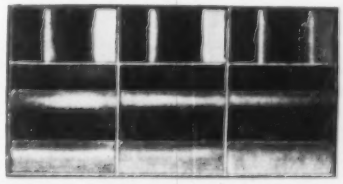
*Reg. U.S. Pat. Off.

A full line of Elof Hansson silencers to effectively reduce airborne noise generated by fans in air conditioning, ventilating systems and by power roof ventilators. They are easily and conveniently installed in building structures at low cost due to new mass-production methods made possible by standardizing on modular sizes. Savings are of such proportions that UNI-SILENCER* prices compare favorably with conventional duct lining.

The performance of UNI-SILENCERS,* both as to acoustical attenuation and pressure loss have been tested and certified by independent, impartial outstanding authority. The certified data is guaranteed in writing and bonded. Free engineering service!

Fill out and mail coupon for literature today!

UNI-SILENCERS* are slip-joined in simple manner as with children's building blocks, to fit almost any conditions or requirements.



ELOF HANSSON, INC. ACOUSTICAL DIVISION

711 THIRD AVENUE, NEW YORK 17, N.Y.

ELOF HANSSON, INC., Acoustical Division
711 THIRD AVE., N.Y. 17, N.Y., DEPT. U1-SE

Please send complete literature on performance-guaranteed Uni-Silencers and Uni-Resonators, without charge or obligation.

NAME .....

ADDRESS .....

CITY ..... ZONE .... STATE .....

WHO'S WHAT

Continued

▶ *POWERS REGULATOR CO.* — HFB Control & Equipment Co., El Paso, Tex. agent; new address of Powers' Buffalo office is 2555 Elmwood Ave.

▶ *PITTSBURGH CORNING CORP.* — John H. Price, Jr., regional sales manager for the eastern section of the country; Edward H. Martin, Jr., regional sales manager for midwestern and western United States and Canada.

▶ *MASON PRODUCTS, INC.* — T & H Enterprises, Fort Lauderdale, sales representative for Florida; Tennessee Heating Sales Co., Knoxville, Tenn., sales representative for state of Tennessee east of Tennessee River and part of Kentucky.

▶ *TRION, INC.* — Rupert-Ryan Co., Cleveland, representative; Air Conditioning Distributors, Inc., Toledo, and Lookout Supply Co., 1001 S. Hawthorne St., Chattanooga, Tenn.

▶ *WOLVERINE TUBE, DIV. of CALUMET & HECLA, INC.* — Travis E. Mosier, sales representative for Chicago Metropolitan Area.

▶ *AMANA REFRIGERATION, INC.* — Cary A. Austin, sales manager in Pittsburgh, Buffalo, Toronto and Rochester, N. Y. areas, with headquarters in Trenton, N. J.; G. P. Hinkley, Jr., sales manager for Boston, Albany, N. Y., Portland, Me., and Montreal territories with headquarters in Hingham, Mass.

▶ *LOSCH BOILER CO.* — Pyramid Grate Co., New York, distributor and service agent for New York Metropolitan Area.

▶ *BABCOCK & WILCOX CO.* — G. H. Weight, sales manager,—middle states with headquarters in Chicago; J. H. Roach, sales manager of Tulsa office; W. C. Mohrman, sales manager of Houston office.

▶ *A. M. BYERS CO.* — Following have been appointed field service engineers: R. E. Beisler and R. Spurgin, Chicago; N. J. Cremonese, Silver Spring, Md., G. F. Grey and W. O. Williams, Houston; M. E. Hanley, New York; L. H. Hawks, Boston; E. M. Jones, Pensacola, Fla.; K. E. MacDonald, Cleveland; L. L. Swaney, Pittsburgh.

▶ *GENERAL ELECTRIC CO.* — Newly appointed distributors for halogen and mass spectrometer detec-

stop the high cost of corrosion

in closed recirculating water systems with CORROSION INHIBITOR CS

Corrosion Inhibitor CS has a special auxiliary inhibitor that gives corrosion protection to brass and copper as well as to other metals normally found in closed systems. This unique property of Corrosion Inhibitor CS assures complete corrosion control with the result that maintenance costs are lowered, pipe replacements and equipment failures are reduced.

Corrosion Inhibitor CS has no tendency to sludge or scale at high concentrations. It will not stain and does not affect normal skin. CS treatment is compatible with common antifreeze. It provides positive protection for systems in standby.

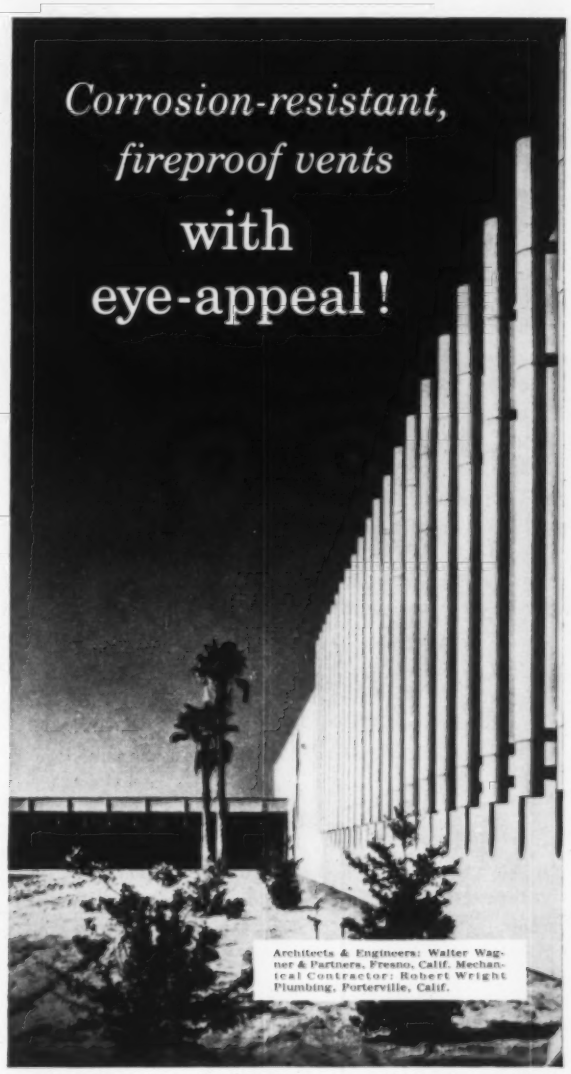
If you have a corrosion problem in any type of closed recirculating water system, write for our free bulletin. Learn how Corrosion Inhibitor CS can help stop the high cost of corrosion.

Corrosion Inhibitor CS stops pitting like this as well as other forms of corrosion.

HAGAN CHEMICALS & CONTROLS, INC.

HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY, HALL LABORATORIES
IN CANADA: HAGAN CORPORATION (CANADA) LIMITED, TORONTO

Corrosion-resistant, fireproof vents with eye-appeal!


Architects & Engineers: Walter Wagner & Partners, Fresno, Calif. Mechanical Contractor: Robert Wright Plumbing, Porterville, Calif.

New plant at Porterville, Calif., has twenty-two 8" Transite exhaust flues.

Vertical exposed flues of Transite Vent Pipe form eye-catching design on new Rockwell Manufacturing Co. installation

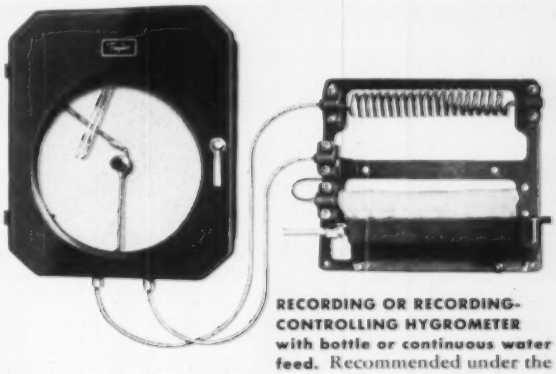
A glance at this attractive new plant tells you that the material used for the exhaust flues is vital to the plant's appearance and maintenance economy. That's why Walter Wagner & Partners, Architects & Engineers, of Fresno, Calif., chose Transite Industrial Vent Pipe to exhaust corrosive fumes from the plant's small parts casting pots.

Made of asbestos-cement, Transite® retains its good appearance. Never needs painting or preservative coating. Resists the attack of most gases, mists, fumes, and dusts. Indoors or out, Transite offers you these same appearance and maintenance-free advantages. Let us send you DS-336—a 24-page brochure on Transite Industrial Vent Pipe. Write Johns-Manville, Box 14 HP, New York 16, N. Y. In Canada, Port Credit, Ontario.

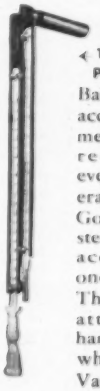
JOHNS-MANVILLE
100 YEARS OF QUALITY PRODUCTS—1858-1958

JM PRODUCTS

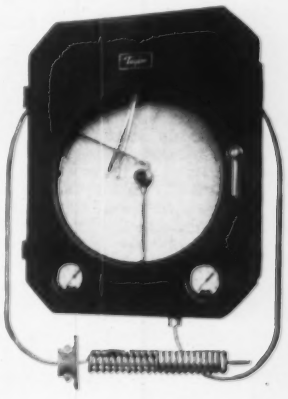
TAYLOR AIDS *to Air Conditioning*



RECORDING OR RECORDING-CONTROLLING HYGROMETER with bottle or continuous water feed. Recommended under the following conditions: Good air circulation; panel advantageously located within apparatus room or duct for best circulation across the bulbs. Available with bottle-feed or continuous water supply.



NEW TAYLOR SLING PSYCHROMETER
Basic standard for accurate measurement of humidity—redesigned for even simpler operation. New 9" Gold Back etched-stem thermometers accurate within one scale division. The new rigidly-attached swivel handle folds back when not used. Variety of F. and C. ranges available.



TAYLOR FULSCOPE* TEMPERATURE CONTROLLER. Keeps lever motors, diaphragm valves, dampers, etc., in proper sequence to make your air conditioning system work perfectly. Automatically compensates for load changes. Controls refrigeration compressors. Gives you automatic seasonal changeover.

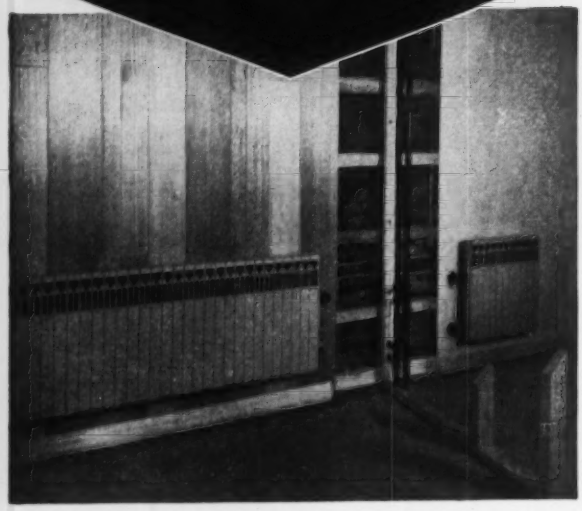
• • •

Ask your Taylor Field Engineer about these instruments, or write for **Catalog 5.** Taylor Instrument Companies, Rochester, N. Y., and Toronto, Ontario.

*Reg. U.S. Pat. Off.

Taylor Instruments
MEAN ACCURACY FIRST

REDUCE piping costs . . . SPEED installation



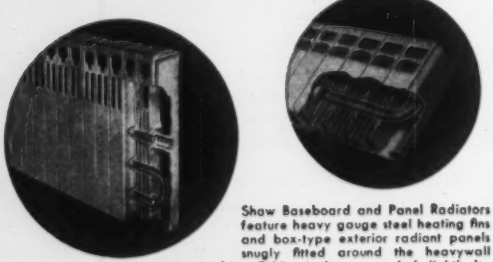
with

SHAW Radiators

Only Shaw, of all modern radiators, offers *same end* as well as opposite end tapping. Same end tapping has a place in almost every piping layout, and its use invariably means less piping materials, simplified pipe fitting.

Important savings in installation time are made with *any* Shaw model, regardless of tapping arrangement. Shaw units are compact, fully self-contained assemblies only 3" thick, easy to handle and mount. There are no dampers, or separate housings to fit and install.

Shaw Radiators distribute both radiant and convected heat in unvarying, health-guarding proportions that create natural thermal comfort in a room. They use either hot water or steam up to 150 psi. Write today for free literature on both panel and baseboard models.



Shaw Baseboard and Panel Radiators feature heavy gauge steel heating fins and box-type exterior radiant panels snugly fitted around the heavywall copper tubing. Tubing is then expanded slightly by 3750# hydraulic pressure to hold all components as a rigid, self-contained unit. The tight metal-to-metal bond assures rigidity and full heat conduction.

SHAW-PERKINS MANUFACTURING COMPANY

201 East Carson St. • Pittsburgh 19, Pa.

WHO'S WHAT *Continued*

tors: Braun Chemical Co., Los Angeles; Braun-Knecht-Heiman, San Francisco; Illinois Testing Laboratories, Chicago; Christie Laboratories, Cleveland; Scientific Supply Co., Seattle; Electro-Tech Equip. Co., New York; Yale Associates, Marblehead, Mass.; Electronic Supply Co., Battle Creek, Mich.; Sunshine Scientific Instrument Co., Philadelphia; Harry Alter Co., Chicago; Carl Hermann Associates, Palo Alto, Calif.; F. J. Stokes, Philadelphia.

▶ *THERMOBLOC DIV. of PRAT-DANIEL CORP.* — Campbell-Elsey Co., Salt Lake City, representative for Utah and part of western Wyoming; C. N. Eckhardt Jr. Co., Glyndon, Md., representative for Maryland, District of Columbia, northern Virginia and parts of West Virginia and Delaware; Temperature Supply Co., Portland, Ore., representative for part of Oregon; Knapp & Co., Spokane, eastern Washington, Montana, eastern Oregon and western Idaho.

▶ *SOLAR AIRCRAFT CO.* — Condit Co., Tulsa, Okla.; T. F. Fitzgerald Co., Boston; Bass Industrial Equipment Co., Buffalo, N. Y.; Bass Industrial Equipment Co., Ltd., Toronto, Ont., Canada; all named as sales representatives.

▶ *A. W. CASH VALVE MFG. CORP.* — Thomas F. Olesko and Paul W. Fisher, factory representatives in northeastern New York, with headquarters in Rensselaer.

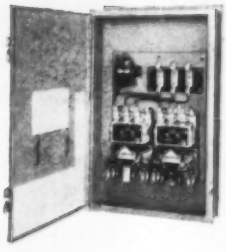
▶ *TRANE CO.* — R. Douglas Hazen, manager of company's newly franchised Miami, Fla., sales office; Robert Plazibat, sales engineer in Flint, Mich., sales office; among new firms appointed as authorized sources: Uniflow Co. of Boston; G. E. Steele, Roxbury, Mass.; John Bright & Associates, San Angelo, Tex.; Tonn & Blank, Inc., Michigan City, Ind.; Pons & Davis, Salt Lake City; Barret Heating & Air Conditioning, Bayshore, L. I., N. Y.; North Shore Heating and Cooling, Inc., Syosset, L. I., N. Y.; Spencer's Electric and Plumbing Co., Leaksville, N. C.; Bridges & Jarrell, Inc., St. Louis.

▶ *CLEAVER-BROOKS CO.* — Richard F. Gray, Portland, Ore., sales representative for Oregon and southern Washington; George K. Moss Co., Birmingham, Ala., sales representative in northern Alabama area; P. H. Hutchinson and Associates, Pensacola, Fla., sales representative in south Alabama and northern Florida; E. L. Herbert Co., Columbus, Ohio, sales representative; Robert E. Sullivan Co., sales representative in area bounded by Cleveland, Akron, Sandusky, Canton. ⧺

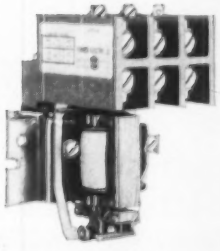
FURNAS ELECTRIC

CONTROLS HELP YOU REDUCE COST AND SPACE REQUIREMENTS

Magnetic Starters in 10 sizes to 100 hp. Furnas starters for control of high horsepower compressors offer the exclusive Furnas "in-between" size starters with dual voltage magnet coils.



Step or Cushion Starting permits the use of larger motors by limiting the inrush current on starting. These methods reduce or completely eliminate objectionable line disturbances due to full voltage across-the-line starting. Furnas Electric offers a complete line of Increment, Auto Transformer and Resistance-type Step Starters.



Furnas contactors feature 20, 24, 30, 35, 40, and 50 ampere sizes to match starter requirements. Silver cadmium oxide contacts for longer life. Floating armature insures quiet operation.

For full information write for Bulletin 5610, 1041 McKee St., Batavia, Ill.

A42

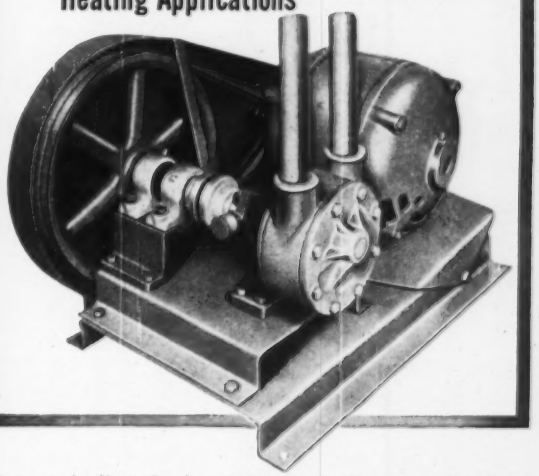
FURNAS ELECTRIC COMPANY

BATAVIA, ILLINOIS

SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES

new TUTHILL SU PUMP UNIT

- **For Handling Heavy Fuel Oils**
- **In Packaged Boiler and Commercial Heating Applications**

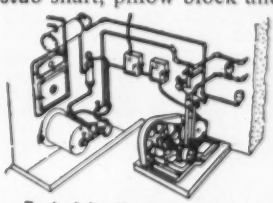


Economically priced, TUTHILL'S SU PUMP UNIT has been specifically developed for handling heavy fuel oils in commercial heating applications and with packaged boilers.

This "v" Belt Driven Unit is compact—complete units measure only 24¼" x 14⅝". Quiet operation is insured by the 2 or 4 "v" Belt Drive and the integral gear positive displacement pump design.

Construction features which provide dependable trouble-free operation, lower maintenance costs, include two ball bearing pillow blocks, one point take-up for simple adjustment of belt tension, removable belt guard and new fabricated steel base with versatile motor mounting.

SU PUMP UNITS can be furnished with a wide variety of pumps and motors for pressures up to 300 psi, capacities to 2030 gallons per hour. Sub-assemblies of pump, stub shaft, pillow block and sub-base are also furnished separately as a unit for incorporation into systems by boiler and furnace manufacturers. Write today for complete information.



Typical Application of SU Unit

TUTHILL PUMP COMPANY
947 East 95th Street, Chicago 19, Illinois
Gentlemen:
Please forward Catalog describing Tuthill SU Pump Units.
NAME_____ COMPANY_____
TITLE_____
STREET_____
CITY_____ STATE_____

TUTHILL PUMP COMPANY

947 East 95th Street, Chicago 19, Ill.

PUMPS FOR YOUR PURPOSE

WE HEAR THAT...

▸ *HUDIK-ROSS CO., INC.* has moved to a two-story, air conditioned building at 171 Atlantic St., Hackensack, N. J. The 150,000 sq ft structure will give the company nearly four times as much space for its office and shop facilities as it had previous to the move in August.

▸ A course in oil heat will be instituted this fall at the College of William and Mary's Technical Institute, Norfolk, Va. The course has been planned and organized with the assistance of the *OIL HEAT INSTITUTE OF AMERICA.*

▸ *AMERICAN AIR FILTER CO., INC.* has revealed plans for a $750,000 addition to the *HERMAN NELSON DIV.* plant in Moline, Ill. The new structure will provide 76,800 sq ft of floor space and will increase the present facilities by half.

▸ Construction has begun on the new 18,000 sq ft eastern research center of *ROBERTSHAW-FULTON CONTROLS CO.*, located on a 20 acre site 15 miles from Philadelphia in King of Prussia, Pa.

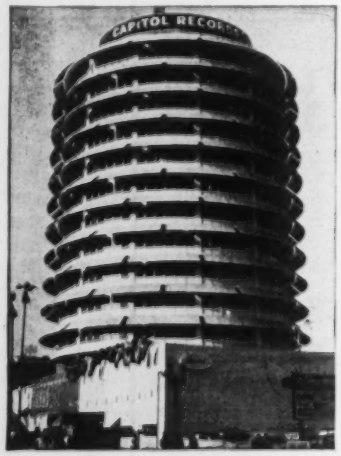
▸ A new laboratory and testing center for hydronics research is being constructed by *SLANT-FIN RADIATOR CORP.* When it is finished the old laboratory will be turned over to the production department, increasing facilities there by 20 percent.

▸ *HANS LIEBLICH & CO., INC.* has completed half a century of service in the mechanical contracting and oil heat installation fields in the New York, New Jersey and Pennsylvania areas.

▸ The Milwaukee School of Engineering recently revised its mechanical engineering curriculum to include courses in air conditioning technology, industrial technology and metallurgical technology.

▸ *EUTECTIC WELDING ALLOYS CO. OF MICHIGAN, INC.* has established a new warehouse service center to serve Detroit area industry at 416 W. Eight Mile Rd.

▸ The new multi-million dollar office building home of *REYNOLDS METAL CO.* will be formally opened this month at Richmond, Va. More than 1,235,000 lb of



CAPITOL RECORDS BLDG.
LOS ANGELES, CAL.

WELTON, BECKET & ASSOCIATES, ARCHITECTS-ENGINEERS, STATE PLUMBING & HEATING CO., MECHANICAL CONTRACTOR

Capitalize on

VISIT OUR BOOTH 624
AT THE INTERNATIONAL EXPOSITION

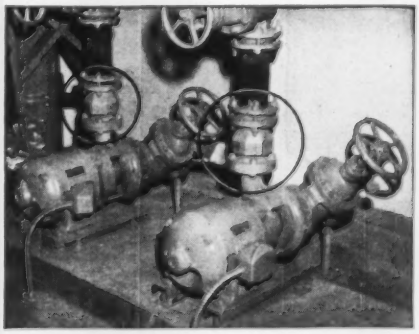
MILLER Streamflow CHECK VALVES

Completely Silences your piping system! CENTER-GUIDED, SHOCK PROOF, NOISELESS, ELIMINATES WATER HAMMER. FULL RADIAL FLOW. FACTORY MUTUAL LABORATORIES APPROVED.

SIZES 1" THROUGH 24".

FLANGED, ASA DRILLING, IBBM, CAST STEEL, ALL ALLOYS. FOR ALL FLUIDS AND GASES.

CERTIFIED MINIMUM PRESSURE DROP CURVE AVAILABLE



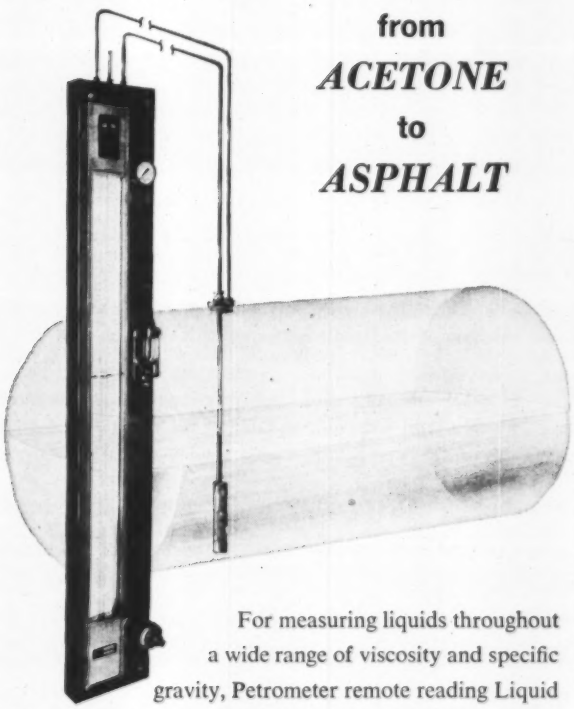
Write for literature • Agents in Principal Cities

MILLER VALVE CO., INC.
Plant—1620 Pennsylvania Ave.

Petrometer

ACCURATELY MEASURES LIQUIDS

from *ACETONE* to *ASPHALT*



For measuring liquids throughout a wide range of viscosity and specific gravity, Petrometer remote reading Liquid Level Indicators have proved themselves to be accurate and reliable. Operating on the unfailing principle of hydrostatic pressure, Petrometer Indicators are designed and constructed with the instrument engineer in mind.

NEW DESIGN FEATURES INCLUDE:

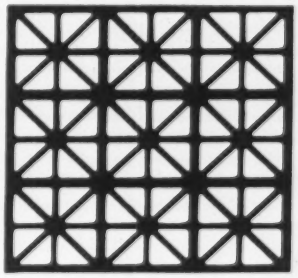
- **All functional parts are on the instrument panel—no need to mount separate parts on the wall.**
- **Integral, one-piece indicating unit.**
- **Channel construction of indicating unit permits easy removal or replacement of scale.**
- **New installation technique permits quick, easy replacement of glass indicator tube.**
- **New front-access method for draining and refilling indicator tube.**
- **Unitized design of functional parts allows instrument engineer to order parts separately for special multi-gauge panel construction.**

write today for Bulletin 6004.

PETROMETER
CORPORATION
43-22 TENTH ST. LONG ISLAND CITY 1, N. Y.

THINK OF HENDRICK for ARCHITECTURAL GRILLES

more than 100 designs to choose from

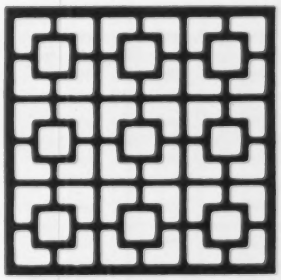


ATTRACTIVE

Hendrick Architectural Grilles combine the functional with the decorative. Many designs are obtainable only from Hendrick.

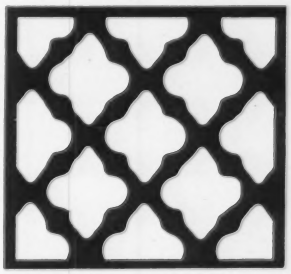
ECONOMICAL

Hendrick Grilles cost less to install and maintain than most architectural materials.



VERSATILE

Each design can be furnished in a wide range of dimensions, with varying numbers and sizes of perforations.



EASY TO INSTALL

Hendrick Grilles always lie flat . . . do not bend or warp. They provide more than enough room for free passage of air.

Write today for more information about Hendrick Grilles.

Hendrick
Manufactring Company
48 Dundaff Street, Carbondale, Pa.

Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Hendrick Wedge Wire Screens • Architectural Grilles • Mitco Open Steel Flooring—Shur-Site Treads • Armorgrids • Hydro Dehazers • Distillation Chemical Column Internals

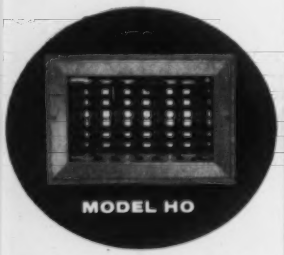
new!

from STANDARD...

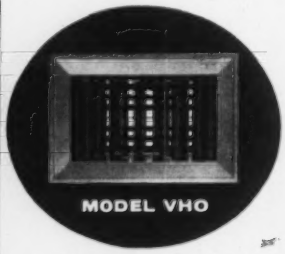
THE *modulaire* SERIES

AIR CONDITIONING REGISTERS and GRILLES

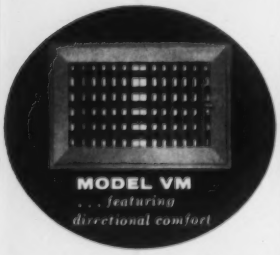
A new concept of "directional comfort" that provides the right pattern and velocity of cool air for any given air conditioned space. MODULAIRE models are available with a variety of face bar combinations to fit any need . . . any application!



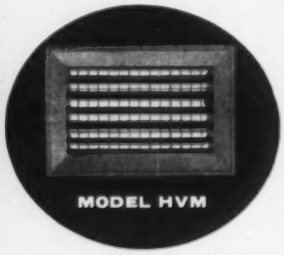
Single Bank Deflection Register With Opposed Blade Dampers.



Double Bank Deflection Register With Opposed Dampers.



Single Bank Deflection Register With Multi-Valve Louvers.



Double Bank Deflection Register With Multi-Valve Louvers.

INCLUDED AMONG STANDARD'S REPRESENTATIVES:

Lee Dewhirst, 139 N. Mead, Wichita, Kansas
George Bollinger, 901 W. Vickery, Fort Worth, Texas
Irwin I. Platsky, 73-35 135th Street, Flushing C, New York
Les Gary, P.O. Box 57, Gates Mills, Ohio
Mike Mitchell, West Jefferson St., Kosciusko, Miss.
H. E. Culley, 414 W. Main St., Louisville, Ky.
G. R. McKenzie, 2811 So. 20th Street, Birmingham, Alabama
Cliff Derbes Associates, Inc., 2430 N.W. 140th Street, Opalocka, Florida
Herbert G. Wilson, P.O. Box 254, Anaheim, Calif.

Mail Coupon Below for free catalogs and information on STANDARD Registers and Grilles for your air-conditioning, heating and two-way system needs!

STANDARD STAMPING & PERFORATING CO., Dept. H-9

3133 W. 49th Place, Chicago 32, Illinois

Gentlemen: Please RUSH . . .

_____ Standard MODULAIRE Air-Conditioning Catalog.

_____ Standard Register and Grille Catalog.

Name_____

Company_____

Address_____

City_____ Zone____ State_____

WE HEAR THAT

Continued

aluminum are contained in the square-shaped, four-level structure.

▸ "Operation Third Phase," an industrial expansion program involving $2 million, has just been initiated by *CLEAVER-BROOKS CO.* Included in the program are a 70,000 sq ft addition to the firm's Lebanon, Pa., manufacturing center and a 25,000 sq ft production facility at Stratford, Ont., Canada.

▸ *NU-WAY CORP.* has announced its purchase of controlling interest in *SUNDSTRAND ENGINEERING CO.* The burner lines of both companies will remain unchanged and each company will operate separately.

▸ Sales engineer Bill Sullaway has been appointed head of the new *HESS, GREINER AND POLLAND* sales office at 3150 El Cajon Boulevard in San Diego, Calif.

▸ *RHEEM MFG. CO.* announced the sale of a plant at San Pablo, Calif., to *KAWNEER CO.* of Niles, Mich. The former company will retain 25 acres at the site for potential future expansion.

▸ *EMBASSY STEEL PRODUCTS* has organized a new industrial and special applications division for the manufacture of component products. Additional manufacturing and warehousing space has been added to take care of the needs of the new division.

▸ Four Ohio air heating experts, Arthur A. Olson, Lee Wilson, T. F. Schilling and John Wehmhoff have launched *AIR HEATERS INC.* with offices in Elyria and Youngstown.

▸ *BARRY BLOWER CO.'s* expansion program has resulted in a 100 percent increase in plant and other facilities.

▸ Installation of new plant facilities in Dallas has been announced by *AEROQUIP CORP.* The new 10,000 sq ft plant will serve both industrial and aircraft markets. Complete facilities will be available for assembly, proof test, inspection of hose assemblies.

▸ *AIR REDUCTION SALES CO.*, a division of *AIR REDUCTION CO., INC.* has broken ground for construction of a new oxygen and nitrogen producing plant in the Armourdale district of Kansas City, Kan. The new plant is intended to serve users of industrial gases within a 300 mile radius of Kansas City and will have a monthly capacity of 5 million cu ft of oxygen.=

KEENEY IS HEADQUARTERS

FOR PRACTICAL DATA TO HELP SOLVE YOUR PROBLEMS IN

HEATING, PIPING & AIR CONDITIONING

Only HP&AC adequately covers all three fields each issue. Best evidence is last year's record: 200 feature pages on Heating . . . 165 pages on Piping . . . 375 on Air Conditioning — total 740 pages, or the equivalent of three books — plus 525 pages in departments and news.

You'll get vital data on correct design, installation, operation, and maintenance — as applied to industrial, commercial, institutional and public buildings.

You could make no better start toward solving your own problems in heating, piping and air conditioning than by knowing what successful engineers and contractors have done in working out similar problems. In HP&AC they discuss actual installations, procedures, equipment, objectives, and how specific problems have been met.

Be Better Prepared in Days Ahead and Have This Practical Help Coming to You!

Mail Order to Keeney Publ. Co.,
6 N. Michigan Avenue, Chicago 2, Illinois

Enter subscription for

Heating, Piping & Air Conditioning to start the first possible issue. I enclose remittance for $..... to cover .....-year period. (Rates in the United States, only $3.00; Canada, Spain and Pan American Union, $4.00; other countries, $6.00 a year.)

My Name .....

Title ..... Firm .....

Street .....

City ..... State .....

Nature of Business .....

BOOKS of reprinted material that originally ran in HEATING, PIPING & AIR CONDITIONING

• CORRECT PRACTICE IN AIR CONDITIONING BUILDINGS

By popular acclaim, an all-new second edition! The best data reprinted from *Heating, Piping & Air Conditioning*. Problem-dissolving information here shows how 43 eminent air conditioning engineers and contractors worked out scores of difficult problems. How-to-do-it facts . . . vital data on design, installation, operation . . . recommended techniques and systems in actual use—for Office Buildings, Hotels, Stores, Hospitals, Insurance Firms, Colleges, Banks, etc. Full 8½" by 11" size. 196 pages, $1.50.

• INDUSTRIAL AIR CONDITIONING HANDBOOK

Information on the purpose, cost, design, operation and maintenance of process and comfort air conditioning systems in manufacturing plants of many kinds. The combined knowledge and experiences of 33 prominent engineers, every one a designer or in direct charge of the largest factory air conditioning systems in operation. This shows other engineers how air conditioning helps speed production, improve products, and increase workers efficiency . . . also how to operate conditioning systems as economically as possible. If improvements and savings in any plant's air conditioning operations are possible, these data and ideas from other plants will certainly suggest the ways to make them.

186 pages, 8½" by 11", $1.50.

• CORRECT PRACTICE IN INDUSTRIAL PIPING
[New Third Edition]

A large collection of outstanding papers and data on industrial piping selected from several years of *Heating, Piping and Air Conditioning*. A comprehensive, practical volume which reveals how various difficult piping problems that arose in different industrial plants were successfully worked out by piping experts. Design, installation, operation, and maintenance . . . steam, air, gas, oil, process, water and refrigeration piping . . . piping in pulp and paper and steel mills, in automobile plants and breweries, in the food and chemical and textile industries, and other manufacturing plants are dealt with from different angles.

196 Pages, 8½" by 11", $1.50.

• CORRECT PRACTICE IN HEATING INDUSTRIAL PLANTS

Practical solutions to specific problems in all kinds of plants, factories, and mills—for changing, expanding, modernizing—planning maintenance—saving fuel—servicing boilers, oil burners—correcting corrosion—figuring heating requirements, also cost of steam—uniform heat control—converting to mechanical firing—snow melting systems, etc. Applications for heating, ventilating, processing, drying—packaged steam generators—heat pumps—unit heaters—radiant panel heating—low-pressure steam—central heating. Articles by 28 heating engineers reprinted from Heating, Piping and Air Conditioning. Full size, 8½" by 11".

132 pages, $1.50.

OK...Ship books checked

- ☐ Correct Practice in Heating Industrial Plants $1.50
- ☐ Correct Practice in Air Conditioning Buildings 1.50
- ☐ Industrial Air Conditioning Handbook 1.50
- ☐ Correct Practice in INDUSTRIAL PIPING 1.50
- ☐ Correct Practice in Heating Large Buildings 1.50
- ☐ Snow Melting Manual ..... .50

Enclosed is check for total of this order $.....
(Add extra postage of 25c each when outside the U.S.A. or Canada.)

SHIP TO ..... TITLE .....

COMPANY .....

STREET .....

CITY ..... Zone ..... State .....

Nature of Business .....

Send Your Order to HEADQUARTERS:

KEENEY PUBLISHING COMPANY
6 NORTH MICHIGAN AVE., CHICAGO 2, ILL., U.S.A.

MEETINGS & CONVENTIONS

1958

SEPT. 15-19—*Instrument Society of America*, instrument-automation conference and exhibit. Philadelphia Convention Hall, Philadelphia. Information: Fred J. Tabery, Exhibit Manager, Instrument-Automation Conference and Exhibit, 3443 S. Hill St., Los Angeles 7.

OCT. 5-8—*National Association of Corrosion Engineers*, technical session. Hotel Somerset, Boston. NACE headquarters: 1061 M & M Bldg., Houston 2.

OCT. 12-15—*Refrigeration and Air Conditioning Contractors Association*, annual convention. Broadmoor Hotel, Colorado Springs, Colo. Refrigeration and Air Conditioning Contractors Association, 10660 Carnegie Ave., Cleveland 6.

OCT. 13-15—*American Gas Association*, annual convention. Atlantic City. AGA headquarters: 420 Lexington Ave., New York 17.

OCT. 13-15—*National Electronics Conference*, conference and exhibition. Hotel Sherman, Chicago. Information: National Electronics Conference, Inc., 84 E. Randolph St., Chicago 1.

OCT. 20-24—*46th National Safety Congress and Exposition*. Conrad Hilton, Congress, Morrison, LaSalle Hotels, Chicago. Information: R. L. Forney, Secretary, National Safety Council, 425 N. Michigan Ave., Chicago 11.

OCT. 21-23—*National Association of Corrosion Engineers*, south central region conference. Roosevelt Hotel, New Orleans. NACE Headquarters: 1061 M & M Bldg., Houston 2.

OCT. 22-24—*Air-Conditioning and Refrigeration Wholesalers Association*, annual meeting. Sheraton-Palace Hotel, San Francisco. Information: 2607 N. High St., Columbus, Ohio.

NOV. 11-13—*National Association of Practical Refrigerating Engineers, Inc.*, annual meeting. Kenilworth Hotel, Miami Beach, Fla. National Association of Practical Refrigerating Engineers, Inc., 435 N. Waller Ave., Chicago 44.

new LC* dynafans by PENN

REDUCE ROOF EXHAUSTER HEIGHTS

ALMOST ONE HALF!

LOW
LOWER
LOWEST

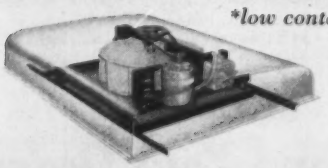
Penn's new Low Contour Dynafans now offer unlimited possibilities for architectural building designs where streamlined silhouettes are desired.

Reduced in height to almost one-half the size of conventional exhausters, this versatile unit contains all of the important features found in Penn's standard model LVQ (Low Velocity Wheel Design) units plus many improvements for lengthening unit life due to new straddled bearing design.

Complete performance data and technical information can be had by writing for Dynafan Bulletin PD-42LC or contacting the Penn Ventilator man in your area.

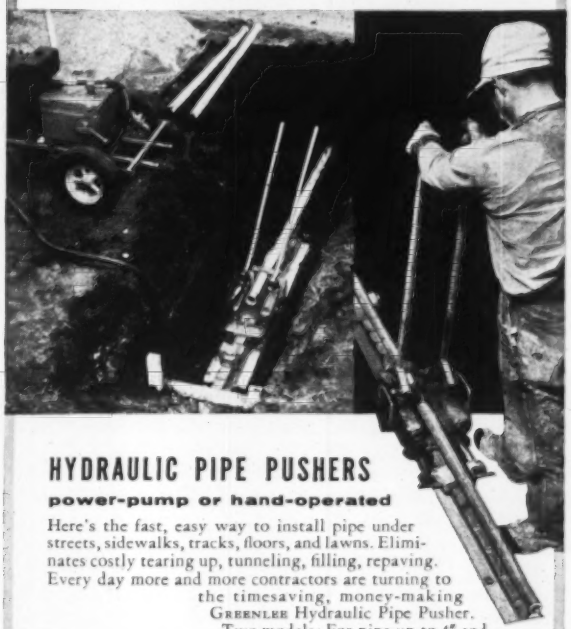
Representatives and distributors in principal cities • Charter member of AMCA

*low contour



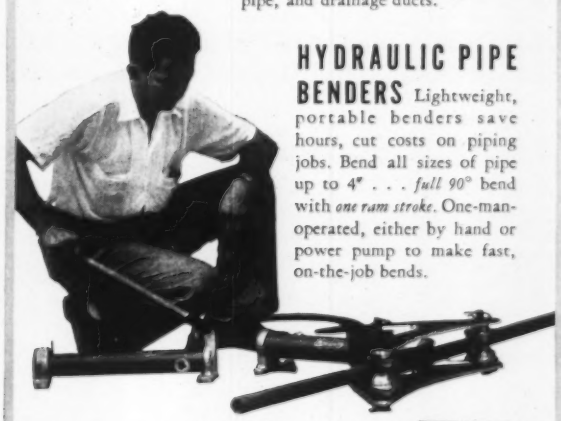
PENN VENTILATOR CO., Inc.
Philadelphia 40, Pa.

CUT COSTS, SPEED JOBS
with timesaving Greenlee tools



HYDRAULIC PIPE PUSHERS
power-pump or hand-operated

Here's the fast, easy way to install pipe under streets, sidewalks, tracks, floors, and lawns. Eliminates costly tearing up, tunneling, filling, repaving. Every day more and more contractors are turning to the timesaving, money-making GREENLEE Hydraulic Pipe Pusher. Two models: For pipe up to 4" and for larger size pipe, concrete sewer pipe, and drainage ducts.



HYDRAULIC PIPE BENDERS
Lightweight, portable benders save hours, cut costs on piping jobs. Bend all sizes of pipe up to 4" . . . *full 90°* bend with *one ram stroke*. One-man-operated, either by hand or power pump to make fast, on-the-job bends.

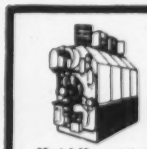
PLUMBERS' PIPE BIT SET
For fast, accurate boring of holes in wood for ½" through 2" pipe. Designed for use in portable electric drills. Adapter also provided for use of bits with auger bit brace.

HEXAGON-SHANK POWER BITS
True-boring ship augers with hexagon shank for positive, nonslip drive. Fit ¼" and larger chucks and ½" round sockets. Choice of points and twists. Wide size range.

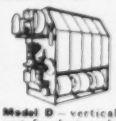
GREENLEE

GREENLEE TOOL CO.
2349 Twelfth Street
Rockford, Illinois

SEND TODAY FOR LATEST HEATER DATA



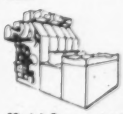
Model H — vertical unit with discharge heads. 12 sizes.



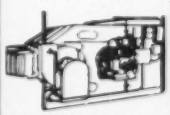
Model D — vertical unit for duct work. 12 sizes.

Model P — portable, vertical unit for flexible duty. 6 sizes.

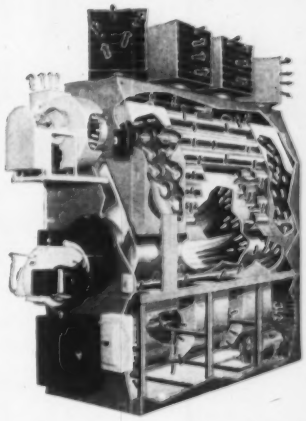
Model R — inverted unit with discharge heads at bottom. 12 sizes.



Model S — vertical unit with side blowers to permit proper location of air mixing dampers. 12 sizes.



Model C — horizontal ceiling suspension unit for space saving. 12 sizes.



Tempering Make-up Air? Drying? Space Heating?

Let National Heater Company show you how space heating and ventilating problems can be solved **efficiently** and **economically.** No matter how large or small a plant may be, National Champion Heaters **save** money on installation, operation and maintenance.

NATIONAL Champion
DIRECT FIRED HEATERS

6 Models 66 Sizes
400,000 to 3,000,000 BTU's
Automatic Operation
PLUS Year-Round VENTILATING!

Direct-fired for gas, oil and combination fuels. Approved by American Gas Association. Listed by UL.

WRITE TODAY FOR A NEW 6-PAGE BROCHURE LISTING SPECIFICATIONS AND DIMENSIONAL DATA OF 1958 LINE OF NATIONAL CHAMPION HEATERS.

NO OBLIGATION! MAIL THIS COUPON TODAY!

NATIONAL HEATER CO., Inc., 2475 Doswell Ave., St. Paul 8, Minn.

Gentlemen:

We're interested in knowing more about National Heaters as noted below:

☐ Send additional material on the **1958** line.

☐ Have your representative call on us.

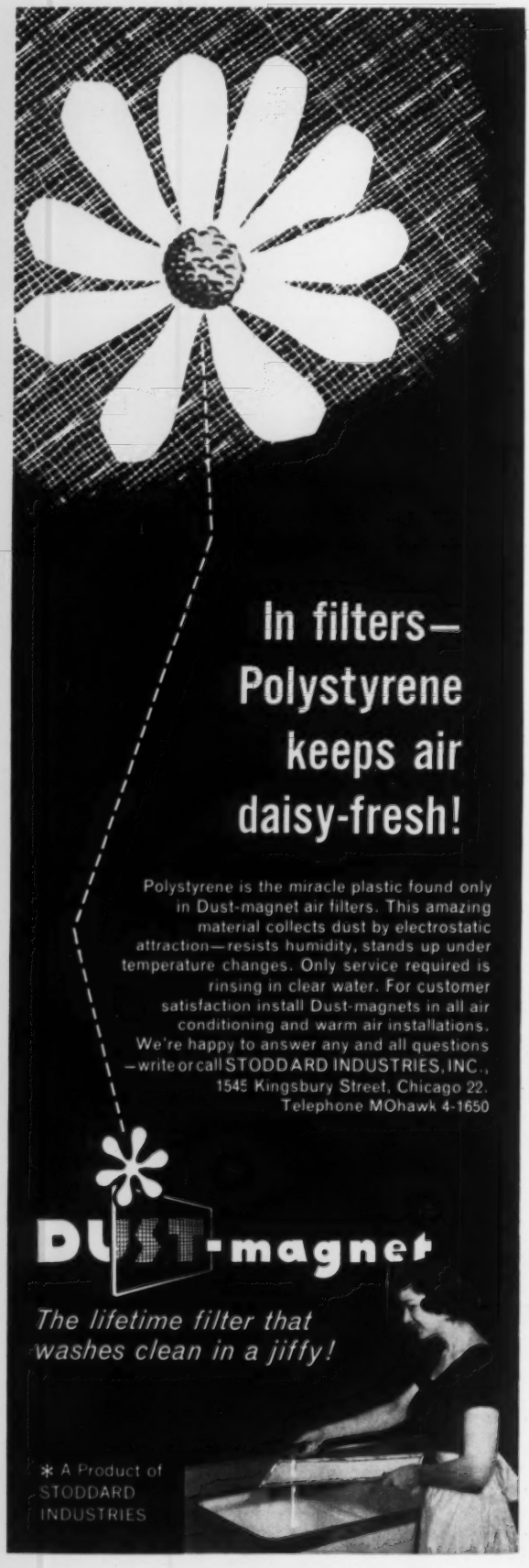
FIRM NAME: _____

ADDRESS: _____

BY: _____

POSITION: _____

NATIONAL HEATER CO., INC.
2475 Doswell Ave., St. Paul 8, Minn.


In filters—
Polystyrene
keeps air
daisy-fresh!
Polystyrene is the miracle plastic found only in Dust-magnet air filters. This amazing material collects dust by electrostatic attraction—resists humidity, stands up under temperature changes. Only service required is rinsing in clear water. For customer satisfaction install Dust-magnets in all air conditioning and warm air installations. We're happy to answer any and all questions—write or call STODDARD INDUSTRIES, INC., 1545 Kingsbury Street, Chicago 22. Telephone MOhawk 4-1650
Dust-magnet
The lifetime filter that washes clean in a jiffy!
* A Product of STODDARD INDUSTRIES

MEETINGS & CONVENTIONS *Continued*

1958

NOV. 17-21—*Society of the Plastics Industry, Inc.*, eighth National Plastics Exposition. International Amphitheater, Chicago. To be held concurrently with the SPI annual national conference, Morrison Hotel, Chicago. SPI headquarters: 250 Park Ave., New York.

NOV. 18-20—*American Standards Association*, meeting. Roosevelt Hotel, New York. American Standards Association, 70 E. 45th St., New York.

DEC. 1—*American Society of Heating and Air-Conditioning Engineers*, special meeting. Conrad-Hilton Hotel, Chicago. ASHAE headquarters: 62 Worth St., New York 13.

DEC. 1-3—*American Society of Refrigerating Engineers*, semi-annual meeting. Roosevelt Hotel, New Orleans, La. American Society of Refrigerating Engineers, 234 Fifth Ave., New York 1.

DEC. 1-4—*National Warm Air Heating and Air Conditioning Association*, annual convention. Cleveland, Ohio. Information: 640 Engineers Bldg., Cleveland 14.

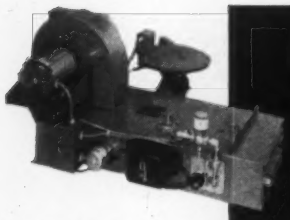
DEC. 1-5—*American Society of Mechanical Engineers*, national exposition of power and mechanical engineering. New York Coliseum, New York. Information: International Exposition Co., 480 Lexington Ave., New York 17.

1959

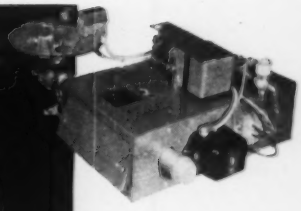
JAN. 19-20—*Industrial Heating Equipment Association, Inc.*, meeting. Cleveland, Ohio. IHEA headquarters: 1145 19th, N.W., Washington 6, D. C.

JAN. 26-29—*Plant Maintenance and Engineering Show and Conference*. Cleveland Public Auditorium, Cleveland, Ohio. For information, contact: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

JAN. 26-30—*14th International Heating and Air-Conditioning Exposition*. Philadelphia. Under auspices of the American Society of Heating and Air-Conditioning Engineers, in conjunction with its 65th annual meeting, also in Philadelphia. Exposition management: International Exposition Co., 480 Lexington Ave., New York 17. ASHAE headquarters: 62 Worth St., New York 13.



POWER OR ATMOSPHERIC
Multuri Burners
that EXCEED Standards of
EFFICIENCY! PERFORMANCE! SAFETY!



Power Multuri burners available in standard units with input capacities to 19,600,000 BTU's. Larger burners or special adaptations available.

Multuri Burners available in 4 to 54 mixers. Standard capacities 700,000 to 9,450,000 BTU/hr. Higher capacites available.

GORDON BYDAND

ROBERTS-GORDON POWER MULTURI GAS BURNERS

Ideal for commercial and industrial boilers, such as scotch marine, steel firebox, downdraft, refractory types, warm air furnaces, drying units, etc. Power Multuri burners can often be used in conjunction with presently installed stokers or oil burners, permitting quick changeover to auxiliary standby fuel, and can be operated with natural or induced draft.

ROBERTS-GORDON MULTURI (Atmospheric) BURNERS

A PREMIX TYPE GAS BURNER, ideal for commercial and industrial size boilers and warm air furnaces. Gives maximum performance from hard-to-fire Scotch Marine and steel fire box boilers. Controlled flame characteristics make the burner a natural for units with extensive refractory surface. Suitable for any gas at 4" gas pressure or more. Permits high firing rates at high efficiency.

Multuri Burners are completely wired and Assembled — Ready for Immediate Installation. Simple to Install, Adjust, Operate!

Write for detailed information—or for a questionnaire listing all the data necessary for correct specifications and efficient installation.

ROBERTS-GORDON Appliance Corp.
44 CENTRAL AVE. BUFFALO 6, N. Y.
In Canada . . . ROBERTS-GORDON APPLIANCE CORP., LTD., *Grimsby, Ont.*

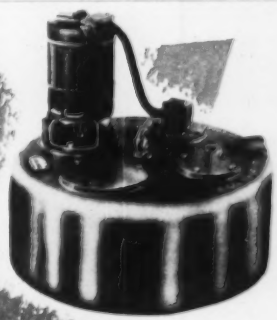
Gas Heating Equipment
- FURNACES
- COOLING UNITS
- BOILERS
- UNIT HEATERS
- GAS BURNERS

THE **weil** TVC

New 26 Gallon TVC Receiver

Condensate Pumps
- LOW RETURN CONNECTION
- LOW SPEED — LONG LIFE
- CAST IRON RECEIVER
- LOW WATER LINE

Capacities to 15,000 sq. ft. E.D.R.



Features:
Low speed (1750 RPM) TVC pumps are easily installed in areas where space is important. Their compact cast iron receiver and sturdy pumping unit assure a trouble-free installation.

Dimensions:
26 gallon cast iron receiver for single or duplex units: Diameter 25"; height of return above floor 10½"; height of unit 36" max.

Installation:
Simple installation: one return connection, one discharge connection. Unit is completely assembled at the factory. Send for Bulletin TVC-300.

Send for Bulletin TVC-300

See Catalog in 1958 Sweet's and 1958 Domestic Eng. Cat. Dir.

Available from Jobbers Stocks!

TVC PUMPS now available in capacities from 750 to 15,000 sq. ft. E.D.R.

The three sizes of TVC receivers now offer a complete line of low pressure system condensate pumps to fit all requirements. The LOW RETURN CONNECTION and LOW SPEED — 1750 R.P.M., coupled with the built-in durability, operating efficiency and low cost of these pumps guarantee a satisfactory and trouble free installation. This pump provides gravity drainage for low heating units.

Specify and install a **weil** TVC Pump.

Built for ONE MILLION STARTS . . . without attention

weil PUMP CO.

1514 North Fremont Street • Chicago 22, Illinois

BOOKS of reprinted material from Heating, Piping & Air Conditioning. You'll get same day shipment — postage paid — when you send check with book orders to Keeney Publ. Co., 6 N. Michigan, Chicago 2, Ill.

- ***INDUSTRIAL AIR CONDITIONING HANDBOOK***

Information on the purpose, cost, design, operation and maintenance of both process and comfort air conditioning systems in manufacturing plants of many kinds. The combined knowledge and experiences of 33 prominent engineers, every one a designer or in direct charge of the largest factory air conditioning systems in operation. This shows other engineers how air conditioning helps speed production, improve products, increase worker efficiency and operate systems economically. 186 pages, $1.50

- ***CORRECT PRACTICE IN HEATING INDUSTRIAL PLANTS***

Solutions by 28 heating engineers to specific problems in plants, factories, mills, etc.—for changing, expanding, modernizing—planning maintenance—saving fuel—servicing boilers, oil burners—correcting corrosion—figuring heating requirements, also cost of steam—uniform heat control—converting to mechanical firing—snow melting systems, etc. Applications for heating, ventilating, processing, drying—packaged steam generators—heat pumps—unit heaters—radiant panel heating—low pressure steam.
132 8½ by 11 Pages, $1.50

- ***SNOW MELTING MANUAL***

Complete information on correct design, installation and operation of snow melting systems is offered in this reprint of articles originally published in "Heating, Piping and Air Conditioning." Design data based on a study of—and others' actual experience with—over 100 snow melting systems of all kinds. Applications illustrated, for loading platforms and docks; sidewalks; roads; driveways; marquees; parking areas; runways; railway switches, etc. 20 pages, $0.50

★ ★

MEETINGS & CONVENTIONS *Continued*

1959

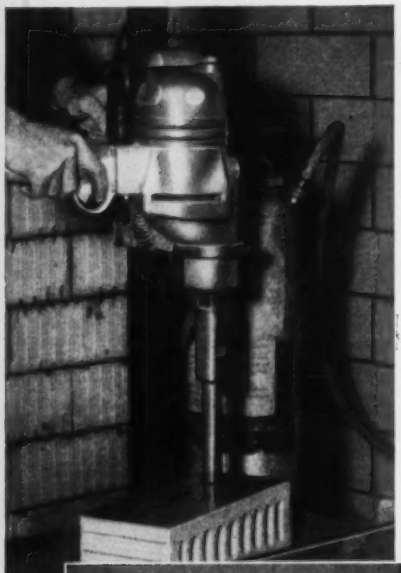
FEB. 3-5—*Society of the Plastics Industry, Inc.*, 14th SPI reinforced plastics division conference. Edgewater Beach Hotel, Chicago. SPI headquarters: 250 Park Ave., New York 17.

MAR. 16-20—*National Association of Corrosion Engineers*, 1959 Corrosion Show and 15th annual conference. Sherman Hotel, Chicago. National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

APRIL 1-3—*Gas Appliance Manufacturers Association*, annual meeting. The Greenbrier, White Sulphur Springs, W. Va. GAMA headquarters: 60 E. 42nd St., New York 17.

APRIL 5-9—*Nuclear Congress*. Cleveland Auditorium, Cleveland. Information: Engineers Joint Council, 29 W. 39th St., New York 18.

APRIL 29-*MAY* 4—*Oil-Heat Institute of America, Inc.*, annual convention. Seattle, Wash., Oil-Heat Institute of America, Inc., 500 Fifth Ave., New York 36. ≠



TRUCO® does it again!
BIG SAVINGS in tile installation

JOB: Cutting 3500 holes 1", 1½", 2" and 2½" dia. through structural glazed and facing tile to admit plumbing pipes in walls of kitchens and washrooms in Ford Motor Company's Staff and Product Engineering Buildings, Dearborn, Michigan.

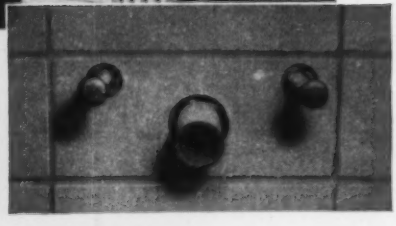
CONTRACTOR: Smith Fireproofing Company, Detroit.

TOOLS: Truco Hand Swivel Drill Motor, a heavy duty unit operating at 1000 rpm with integral Truco Water Swivel and Truco Drill Stand mounted on a wheeled platform, readily movable to each work site.

OPERATION: The previous method required a sawing operation in a separate room to which tile was carried at considerable cost in man-hours. Much chippage, scrap, waste and dirt resulted. Pieces of tile had to be patched in around pipes, taking more time and leaving an unsightly job. With Truco equipment right at the work site, tile was placed on a board, holes drilled in less than three minutes per hole, and the tile laid up in the wall. Holes were accurate, fitted neatly, and there was no unsightly patching, no chippage, practically no scrap or litter. Truco equipment delivered a perfect job at a fraction of previous cost.

Write or phone for nearest distributor's name.

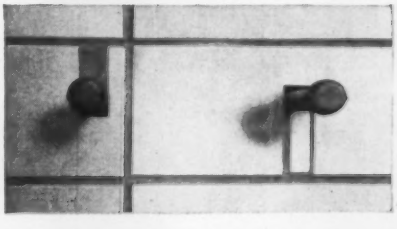
TRUCO MASONRY DRILLING DIVISION
WHEEL TRUEING TOOL COMPANY
57-3200 W. Davison Ave. • Detroit 38, Michigan



Top, left: Drilling accurate holes for plumbing in glazed structural tile averages less than 3 minutes per hole with Truco diamond drilling equipment.

Bottom, left: Finished holes are neat, clean, accurate, and need no patching.

Bottom, right: Old method involved sawing slots which required patching, and left unsightly wall scars.

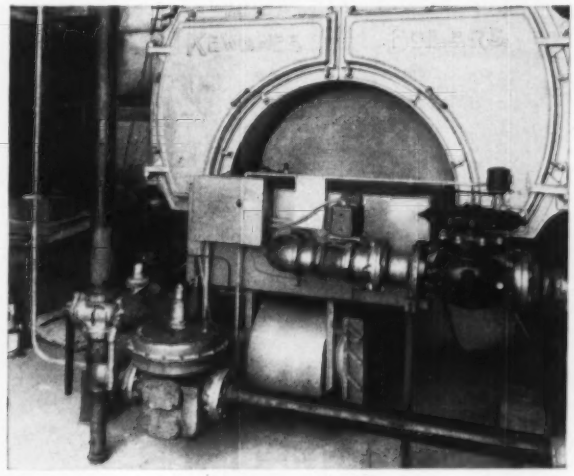


Hot water for 1,000 cabanas

heated at less-than-expected cost by

LO-BLAST

POWER GAS BURNER



At beautiful Malibu Beach Club, Lido Beach, Long Island, N. Y., the hot water demand of these cabanas creates an exceptionally heavy load. 1000 showers and the kitchen facilities of two restaurants are amply and economically supplied by a 450 horsepower Scotch Marine boiler, automatically gas-fired by a 20,000,000 BTU-Lo-BLAST Burner. Manufactured gas is furnished by the Long Island Lighting Company, which reports that *operating cost is less than estimated at the time of installation!*

Lo-BLAST Power Burners use an extremely quiet, low-speed blower to provide perfectly controlled primary and secondary air...operation is always independent of natural draft. These burners eliminate the need for high chimneys—inshot design reduces maintenance cost. All units are completely assembled and tested on gas before shipment.

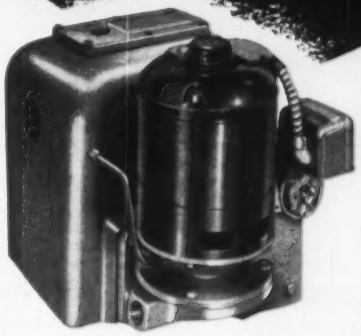
Capacities 75,000 — 20,000,000 BTU/hr. input.

Lo-BLAST Burners average 10% less in operating cost!

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

IT'S NEW! IT'S TOPS!

it's the Sterlco® 4223-E LOW PRESSURE CONDENSATE PUMP



- ☆ SURPRISING VERSATILITY
- ☆ UNUSUAL CAPACITY
- ☆ TREMENDOUS PERFORMANCE
- ☆ ECONOMICAL PRICE

- **DESIGNED SPECIFICALLY FOR SMALL INSTALLATIONS . . .** yet adequate for jobs up to 3000 sq. ft. EDR.
- **ALLOWS ACCURATE ADJUSTMENT . . .** Float switch travel can be adjusted for a draw of from .7 to 3 gals. per pumping cycle for close adjustment to boiler requirements.
- **SMALLER IN SIZE, YET BIGGER IN USABLE VOLUME . . .** a truly believe-it-or-not design. Although the 5 gal. cast iron tank is one of the smallest, it has greater "draw" or usable volume than many pumps with larger tanks.
- **LOTS OF EXTRA CAPACITY FOR EMERGENCIES . . .** Equipped with the same pump and motor used for the larger capacity ¼ h.p. Sterlco pumps.
- **TAKES LESS SPACE THAN ANY OTHER . . .** Occupies only 1.6 sq. ft. of floor space. Fits easily into almost any small corner because of rectangular shape and convenient location of motor and switch at front of unit.
- **EXCEPTIONALLY QUIET, RUGGED, DEPENDABLE . . .** Includes the same high quality features found in Sterlco's heavy duty pumps.

USE THE RIGHT PUMP FOR THE JOB!

The addition of the No. 4223-E makes the Sterlco 4100-4200 Series Condensation Pumps one of the most complete lines of low pressure pumps on the market.

Write now for complete information.

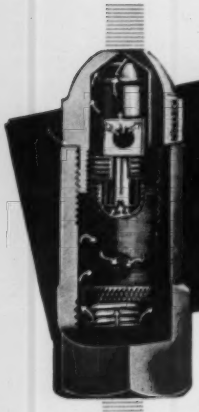
Sterlco Products Distributed Through Leading Heating and Plumbing Wholesalers. Representatives in all principal cities.

STERLING, INC.
5202 W. Clinton Ave., Milwaukee 18, Wisconsin

CONDENSATION AND VACUUM PUMPS

HEATING SPECIALTIES

TEMPERATURE CONTROLS



Monarch

NOZZLES For HUMIDIFYING

Monarch Brass F-80 Air Conditioning Nozzles (or ¼" male one-piece H-261 style) produce the finest possible breakup of small capacities with low direct pressure only. No air required.

The most popular size is #3.00 which operates on as little as 25 pounds pressure, delivers 1.00 gph and produces a very wide angle of spray (120°) in a fine, soft, fog-like mist.

Available in 25 different capacity sizes from .57 gph upwards, all Brass construction with 120 mesh Monel screen strainers.

WRITE FOR CATALOG I

Monarch MFG. WORKS, INC.
2523 E. ONTARIO ST.
PHILADELPHIA 34, PA.

Canadian Agents: (Except B. C.)
E. S. Gallagher Sales Ltd., Toronto 12, Canada

NEW BOOKS & REPORTS...

BUILDING CODES, COMPILATION OF STANDARDS. 1060 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $8.00

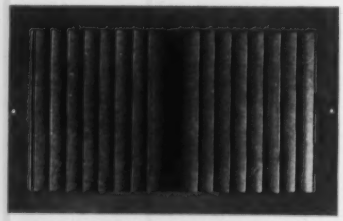
MANUAL OF ACCIDENT PREVENTION IN CONSTRUCTION, FIFTH REVISED EDITION—Compiled and edited by D. A. Buzzell. Associated General Contractors of America, Inc., 20th and E Sts., N. W., Washington 6, D. C. $3.25

PRESSURE LOSSES THROUGH FORCED-AIR PERIMETER FITTINGS AND SUPPLY OUTLETS, Eng. Exp. Station Bulletin No. 449—By M. V. R Rao, Donald R. Bahnfleth, Herbert T. Gilkey. Office of Publication. University of Illinois, 2 Administrative Bldg. (East), Urbana, Ill. $1.00

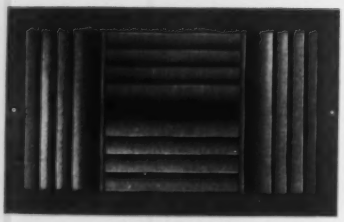
STANDARD ON INCINERATORS. 24 pp. National Fire Protection Association, 60 Batterymarch St., Boston 10. 50c

TABLES OF TRANSPORT INTEGRALS, NATIONAL BUREAU OF STANDARDS CIRCULAR 595—By William M. Rogers and Robert L. Powell. 46 pp. National Bureau of Standards, Office of Technical Information, Washington 25, D. C. 40c

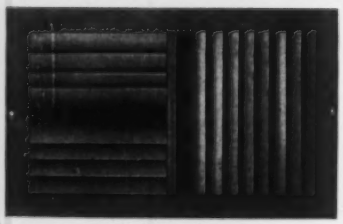
NEW FROM A-J!



A-J 200 AIF



A-J 200 CF



A-J 200 BF

No. 200 SERIES CEILING DIFFUSERS

with 18 different deflection patterns!

Have a special air distribution problem? Solve it quickly, easily, economically with an A-J No. 200 Series Ceiling Diffuser.

Extruded aluminum curved blades provide maximum air control with minimum resistance. Face bars are 1¼" wide on ¾" centers. You can have your choice of multiple valves (No. 230) or opposed blade dampers (No. 240). Available in either sturdy steel or extruded aluminum frames. Aluminum enamel is standard finish.

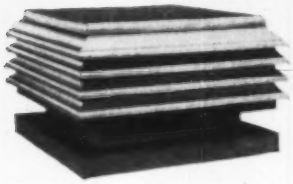
Write for your FREE copy of our new catalog.

A-J

A-J Manufacturing Co.

Dept. H-9 3601 East 18th Street Kansas City 27, Missouri

GREENHECK *Air Movement Devices*



COLUMBUS
Direct Drive centrifugal power roof exhauster. 100 to 1400 CFM. Boston companion series belt drive 500 to 4300 CFM.

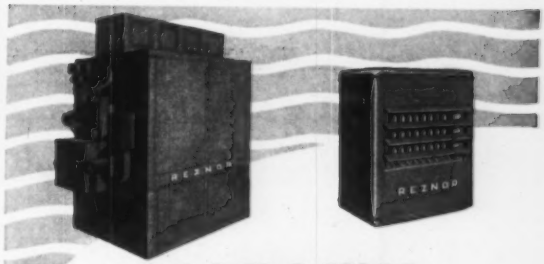
1958 "WAUSAU" AIR MOVER
POWER ROOF EXHAUSTER

You will be specifying the finest when you call for the new "WAUSAU" Air Mover. A completely new concept, this centrifugal belt drive power roof exhauster covers the 300 CFM to 27,000 CFM range and features rugged steel body and frame, extruded aluminum louver fins and a mounting pedestal with removable damper access door. The finest of workmanship and materials assure you of a quality product. Write today for catalog 9 which gives complete engineering information.

DALLAS
Air Mover Belt drive centrifugal power roof exhauster.

Turbine Ventilator Available in aluminum or galvanized.

GREENHECK
FAN & VENTILATOR CORP.
SCHOFIELD • WISCONSIN



economy

BTU for BTU, Reznor gas unit heaters cost much less than most other types of heating equipment. Installation offers additional savings . . . it requires only suspension, gas and electrical connections, and simple venting. And Reznor suspended units help you hold down total cost per usable square foot . . . because they occupy absolutely no valuable floor space.

ECONOMY makes these completely-automatic packaged units the ideal way to heat a wide variety of commercial and industrial buildings. Ask your Reznor distributor for the complete story or write for your free copy of "Modern Heating"

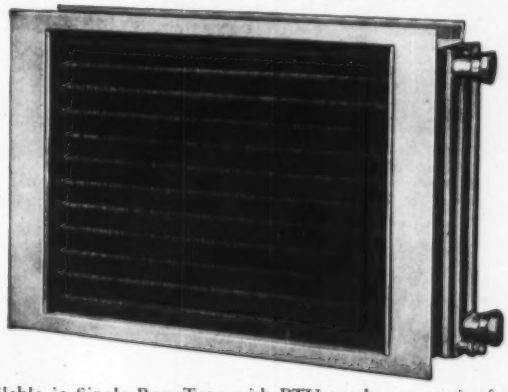
Look for Reznor under "Heaters-Unit" in the Yellow Pages

REZNOR
WORLD'S LARGEST SELLING DIRECT-FIRED
UNIT HEATERS

Reznor Manufacturing Company, 51 Union Street, Mercer, Pa.

New . . . REMPE "Hi-Cap" STEAM HEATING COILS WITH DEFROSTER

For Use in Combination With Air Conditioning Coils Or As Tempering and Booster Units in Long Heating Ducts.



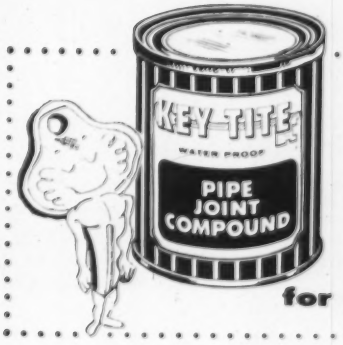
Available in Single Row Type with BTU per hour capacity from 60,000 to 360,000. In Double Row Type, for heavy duty service, in capacities from 129,000 to 775,000 BTU per hour. Heavy gauge steel casings. Copper tubes and headers. Tested 350 lbs. air pressure for steam working pressures up to 125 lbs. Defroster standard equipment. Also suitable for hot water.

Write for Details

HEAT TRANSFER EQUIPMENT REMPE CO. Founded 1930

REMPE COMPANY
342 N. Sacramento Blvd., Chicago 12, Ill.

Complete facilities for fabrication of pipe coils—all types—all materials. Engineering service. Send details for price.



NEW CAN . . . NEW LOOK for **KEY-TITE!**

W-K-M's famous KEY-TITE has a new look. In its bright new orange and green lithographed can, KEY-TITE's good looks now match its fine qualities.

Same Improved Formula. A leader in its field for 35 years, KEY-TITE was still further improved with a new service-tested formula last year. There is no change in this formula which provides a positive seal on water, gas and low-pressure lines, yet won't freeze joints. KEY-TITE remains pliable always—in the can or in the joint.

Look for KEY-TITE in the NEW ORANGE AND GREEN CAN

For FREE Sample write

W-K-M DIVISION OF OCf INDUSTRIES INCORPORATED
Dept. 88-9, P. O. Box 2117, Houston, Texas

KT-5803

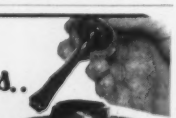
30% Savings on Labor Cost
A Permanent Bond
A Better, Neater Job
with
ST. CLAIR
Specially Formulated
INSULATION ADHESIVE

ST. CLAIR Insulation Adhesive specially formulated for bonding insulation material to metal, supersedes pins and clips, wires, screws, and caps. Provides easier, quicker handling. For bonding immediately or up to 45 minutes later.

Send Today For
CATALOG SHEET—PRICES
SAMPLE

ST. CLAIR RUBBER CO.
440-D EAST JEFFERSON AVE.
DETROIT 26, MICHIGAN

For leakproof, pressure-tight connections..



TiteSeal®
Gasket & Joint
SEALING COMPOUNDS

Heat-proof, vibration-proof. Will not shrink, crack or crumble. Prevents formation of rust and corrosion—makes disassembly easy.

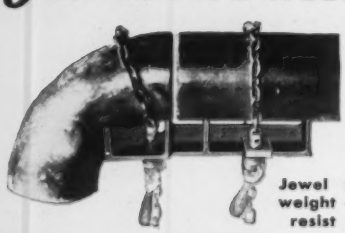
7 Basic Blends

SOLDER SEAL
At your wholesaler!

2194

RADIATOR SPECIALTY CO., Charlotte, N. C.

Jewel PIPE WELDING Clamps



CLAMPS FOR WELDING PIPE • FLANGES • ELBOWS • ANGLES —also PIPE MARKERS

These clamps align the pipe perfectly, and hold it there until it is welded. Two sizes, ½" to 8"; 8" to 16"

Jewel Pipe Clamps are lightweight — rigidly constructed — resist strain, heat and abuse.

ENOUGH JEWEL CLAMPS CUT ERECTION COSTS
JEWEL *MANUFACTURING COMPANY*
1841 University Ave., St. Paul 4, Minn.

NEW BOOKS & REPORTS

Continued

COOLING THE I-B-R RESEARCH HOME WITH A CHILLED-WATER, FAN-COIL SYSTEM, Eng. Exp. Station Bulletin—By Warren S. Harris, Norman B. Migdal and Glenn R. Sward. 32 pp. Office of Publication, University of Illinois, 2 Administration Bldg (East), Urbana, Ill. 50c.

STANDARD FOR THE INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS OF OTHER THAN RESIDENCE TYPE, MAY 1958. 24 pp. National Fire Protection Association, 60 Batterymarch St., Boston 10. 50c

TENTATIVE GUIDE FOR EMERGENCY SMOKE AND HEAT VENTING IN INDUSTRIAL PROPERTIES. 24 pp. National Fire Protection Association, 60 Batterymarch St., Boston 10. 50c

RECOMMENDED PREHEAT AND POSTHEAT WELDING PRACTICES FOR LOW CHROMIUM-MOLYBDENUM STEEL PIPE. Pipe Fabrication Institute, Room 759, One Gateway Center, Pittsburgh 22.

ASTM STANDARD SPECIFICATION FOR SEAMLESS COPPER PIPE, STANDARD SIZES—H 26.1-1958. American Standards Association, PR9, 70 E. 45th St., New York 17. 30c

INDUSTRIAL HYGIENE AND TOXICOLOGY, REVISED EDITION—Edited by Frank A. Patty. 807 pp. General Motors Corp., General Motors Bldg., Detroit 2.

AIR CONDITIONING, 1931-1958—CTR-342. Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. 10c

SELLING TO AEC—Prepared by the Atomic Energy Commission. 34 pp. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

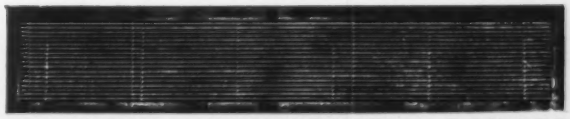
I-B-R BASEBOARD RATINGS APPROVED UNDER THIRD EDITION I-B-R BASEBOARD CODE. Institute of Boiler and Radiator Manufacturers, 608 Fifth Ave., New York 20.

UNITARY HEAT-OPERATED AIR-CONDITIONING EQUIPMENT—ARI Standard 250-58. 6 pp. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C. 35c

UNDERGROUND CORRISION, SUMMARY OF 45 YEARS OF RESEARCH—Summary Technical Report 2209. U. S. Department of Commerce, National Bureau of Standards, Washington 25, D.C.

CLASSIFIED ADVERTISING

Rates for classified advertising are 15 cents for each word including heading and address. One inch $7.00. Count nine words for keyed address. Minimum $2.50 for each insertion. Cash must accompany order. Closing date 10th of month preceding issue.



DIAMOND FABRICATED GRILLES
FOR MODERN PUBLIC BUILDINGS

Heating Engineers asked for a stronger, more durable grille — in harmony with the modern trend toward maintenance-free construction through greater use of Aluminum and Steel. Here's our answer: a Custom-Built Heavy-Duty Bar-Type Grille that provides long-needed protection against the trouble and expense so often caused by replacement of ordinary light-gauge grilles.
Available in any desired size or shape — All Steel or All Aluminum — for straight or deflected air flow. Bulletin 43 gives complete information. Write for free copy.

DIAMOND MFG. CO. WYOMING (Wilkes-Barre Area) **PA.**

Manufacturers, also, of DIAMONTEX, the Perforated Metal Lay-In Panel for Modern Acoustical Ceilings. New illustrated Bulletin gives complete information. Ask for No. 47.

✔ SITUATIONS OPEN

ENGINEER

Prominent manufacturer in northern Illinois has an opening for a graduate Mechanical Engineer who has had experience in the design and development of Industrial Fans, Blowers, and related equipment. Knowledge of dust collecting, spray drying, or air cleaning equipment desirable. Excellent future for young Engineer, 25 to 35, who desires recognition and responsibility. Please send complete resume and salary requirement to Key 1369A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

Mechanical Engineer with broad field experience to supervise installation of heating, ventilation, air conditioning, plumbing — for project in Israel. Minimum three year program. Salary commensurate with ability. Submit resume to Key 1368A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

SALES OR DESIGN ENGINEER — Commercial, Industrial heating and air conditioning. Permanent position with progressive, leading wholesaler in Utah, Idaho and Colorado, handling top manufacturers' lines. Salary and bonus program commensurate with ability. Profit sharing retirement program. Life, sickness, surgery and hospital insurance coverage. Liberal vacation and sick leave. Only experienced and well qualified men will be considered. Address Key 1367A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

MECHANICAL ENGINEER

BACHELOR'S DEGREE OR BETTER

Excellent opportunity investigating Domestic Burner Equipment and Fuels. Studies concerned primarily with Mechanical Factors Influencing Burner operation. Socony Mobil Oil Company, Inc., Technical Service Laboratory, 412 Greenpoint Avenue, Brooklyn 22, New York.

✔ AGENTS WANTED

MANUFACTURER'S AGENTS

An established manufacturer with 25 years ex-perience producing ventilating equipment is looking for manufacturer's agents in many sections of the country to sell their new line of industrial fans.
The products include axial flow and tubeaxial fans, both direct and belt driven, and power roof ventilators. Please reply Key 1361A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

MANUFACTURERS AGENTS—Established Midwest manufacturer of complete line of commercial and industrial steel boilers is expanding distribution area. Seeks experienced representatives in a number of choice territories. Our line consists of sectional steel boilers having advantages in both new and existing building installations. Competitively priced. Have a good proposition for experienced salesmen. CENTRAL STATES BOILER COMPANY, 4649 W. Harrison St., Chicago 44, Ill.

MANUFACTURER's REPRESENTATIVES

Established manufacturer of nationally distributed and advertised PECO electrical construction materials requires manufacturer's representative to sell its proposed line of PECO malleable iron pipe hangers and supports to plumbing supply wholesalers. Write Arthur Levine, General Manager, Producto Electric Corp., 932 Rogers Place, New York 59, New York.

✔ MISCELLANEOUS

MACHINE ENGRAVED PLATES
IDENTIFICATION NAME PLATES engraved for controls, switches, panels, and for electric and electronic control consoles — on black surface bakelite with white lettering or on black anodized aluminum — any titles. VALVE tags engraved on black anodized aluminum for easy reading in dark areas. Quick mail service any distance. Free samples and prices. G. F. BUNNELL CO., 645 Cypress Road, Vero Beach, Florida.

NUMBERED VALVE TAGS — manufactured for Contractors. Free Samples. Immediate shipment. SETON NAME PLATE COMPANY, New Haven 15, Conn.

IDENTIFICATION NAME PLATES for controls and panels — precision engraved on bakelite or black anodized alum. — any titles — quick service by mail on small or large jobs — send for sample and prices. ATLANTIC ENGRAVERS, INC., 232 Ocean Ave., Amityville, N. Y.

✔ SITUATIONS OPEN

SALES ENGINEERS
Air Conditioning company, committed to doubling national sales force in next two years, has immediate openings for sales engineers with ultimate opportunity to become branch managers. Openings available in any section of country. Successful sales experience definite requisite. Salary and commission. Replies confidential. Address Key 1370A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

Heating and Air Conditioning Engineer looking for excellent opportunity in technical writing and editing. Some editorial experience desirable but not necessary. Will prepare technical information for publication gathered from interview with other engineers, correspondence. Interesting work. Good future. Address Key 1366A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

POSITION AVAILABLE

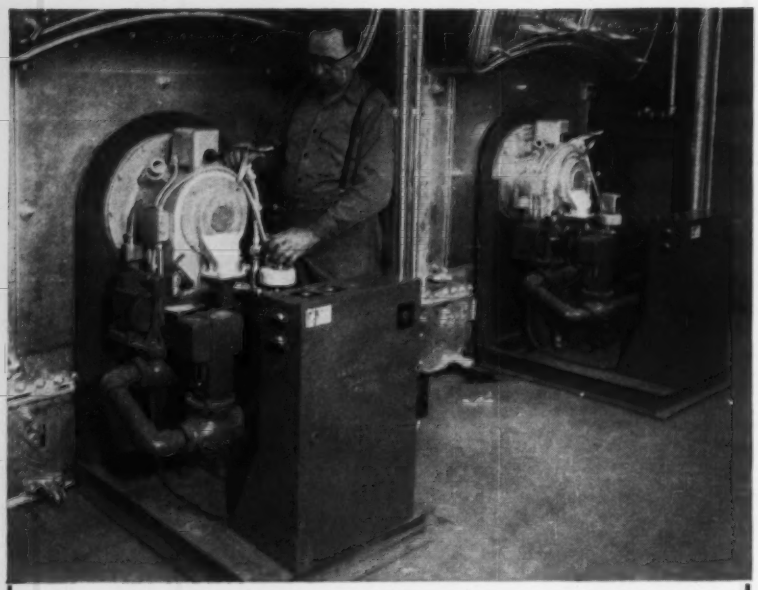
Mechanical Engineer to take charge of New York branch of firm of consulting engineers. Must have minimum of five years on drafting board and design with New York City air conditioning and heating consultant. Profit sharing benefits for college graduate, 35 to 40 years of age, of quiet nature, and willing to work hard. Must be capable of coordinating work with architects and clients and checking all mechanical details. Will supervise a group of 20 engineers and designers, including electrical section. Future partnership assured for man of caliber that can keep satisfied clients. Address Key 1371A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

$ $ $

EXPECTING AN ORDER?

You'll get it quicker if your postal zone number is on the order blanks, return envelopes, letterheads.

The Post Office has divided 106 cities into postal delivery zones to speed mail delivery. Be sure to include zone number when writing to these cities; be sure to include *your* zone number in *your* return address—after the city, before the state.



conversion to

O&S® BURNER SYSTEMS

gains 12 Big Benefits

Formerly coal-fired, these 31-year-old boilers at an Indiana school now deliver steam to the heating system 4 times faster! Conversion to O&S Burner Systems for gas firing is the reason.

Eleven other benefits were gained by changing to these fully automatic burners: (1) uniform temperature, (2) fuel economy, (3) quicker response of boilers to load variations, (4) constant steam pressure, (5) reduced operating costs, (6) trouble-free operation, (7) lower boiler maintenance, (8) less building upkeep, (9) 1200 sq ft of additional office and storage space always comfortably heated, (10) improved cleanliness, and (11) large saving in janitor's time for attending the boilers.

Investigate the economies and other advantages O&S Fuel Burning Systems can bring to your boiler operation. Call in the O&S representative for full information. Send now for bulletin.

Builders of Dependable Boilers & Burners Since 1885

ORR & SEMBOWER, INC.

Morgantown Road, Reading, Pa.

INDEX TO ADVERTISERS

Firms represented in this issue are identified by the page on which their advertising appears. Advertising in other issues is marked with an asterisk.

Acme Industries, Inc. . . . *
Adsco Div., Yuba Consolidated Industries, Inc. . . 111
Aerofin Corp. . . . 188
Aerovent Fan Co., Inc. . . . *
Air & Refrigeration Corp. . . . 270
Air Control Products, Inc. . . . *
Air Devices, Inc. . . . 281
Air Filter Institute . . . *
Air-Maze Corp. . . . *
Air Moving & Conditioning Association . . . *
Airtemp Div., Chrysler Corp. . . . 89
Airtherm Mfg. Co. . . . 67
A-J Mfg. Co. . . . 300
Aladdin Heating Corp. . . . 279
Alco Valve Co. . . . 189
Allen-Bradley Co. . . . *
Allen Cooler & Ventilator Inc. . . . 240
Allen Mfg. Co., W. D. . . . 86, 87
Allis Co., Louis . . . *
Allison-Campbell Div., American Chain & Cable Co., Inc. . . . 78
American Air Filter Co., Inc. . . . 38, 39
American Brass Co., The . . . 22
Amer. Chain & Cable Co., Inc. — R-P&C Valve Div. . . . *
American Chain & Cable Co., Inc. Allison-Campbell Div. . . . 78
American Gas Association . . . 48, 49
American Gilsonite Co. . . . 248, 249
American Hard Rubber Co. . . . 221
American-Marsh Pumps, Inc. . . . 283
American Metal Hose Branch American Brass Co. . . . *
American-Standard, American Blower Div. 50, 51, 202
American-Standard, Plumbing & Heating Div. 46, 47
Ames Iron Works . . . *
Ammerman Co., Inc. . . . 268
Anderson Co., V. D. Div. of International Basic Economy Corp. . . . *
Anemostat Corp. of America . . . 200
Armstrong Cork Co. . . . 312
Armstrong Machine Works . . . 6
Arno Adhesive Tapes, Inc. . . . 284
Aurora Pump Co. . . . *

Babbitt Steam Specialty Co. . . . 310
Babcock & Wilcox Co., Tubular Products Div. 92
Badger Mfg. Co. . . . *
Barber-Colman Co. . . . 68, 69
Barnebey-Chaney Co. . . . 264
Barry Blower Co. . . . 198
Bell & Gossett Co. . . . 7, 237
Bethlehem Steel Company . . . 88
B-I-F Industries, Inc. . . . 305
Binks Mfg. Co. . . . 236
Bituminous Coal Institute . . . *
Boiler Engineering & Supply Co., Inc. . . . *
Bonney Forge & Tool Works . . . *
Bridgeport Brass Co. . . . 25
Bruner Corp., The . . . 33
Buensod-Stacey, Inc. . . . 250, 251
Buffalo Forge Co. . . . 44, 45
Buffalo Pumps, Inc., Div. of Buffalo Forge Co. 53
Builders-Providence, Inc. Div. of B-I-F Ind., Inc. 305
Burgess-Manning Co. . . . *
Burnham Corporation . . . 307
Byers Co., A. M. . . . *

Cain Mfg. Co. . . . 224
Cambridge Filter Corp. . . . 238
Campbell Heating Co. . . . 190
Canton Stoker Corp., Wagener Pump Div. . . . *
Capitol Mfg. & Supply Co. . . . 308
Carey Elec. Engr. Co. . . . *
Carnes Corporation . . . *
Carrier Corp. . . . 52, 267
Carpenter & Paterson, Inc. . . . 281
Carver Pump Co. . . . *
Century Electric Co. . . . 42, 43
Chase Brass & Copper Co. . . . 64
Chesapeake and Ohio Railway . . . *
Chester Cable Co. . . . *
Chicago Blower Corp. . . . *
Chicago Pump Co. . . . 90
Clarage Fan Co. . . . Inside Back Cover
Cleaver-Brooks Co., Boiler Div. . . . 216
Colonial Plastics Mfg. Co. Subsidiary Van Dorn Iron Works Co. . . . 266
Committee on Industrial Ventilation . . . *
Committee on Steel Pipe Research American Iron & Steel Institute . . . 108
Connor Engineering Corp. . . . 30, 187
Continental Air Filters, Inc. . . . 191
Crane Co. . . . 105
Curtis Refr. Machine Div. of Curtis Mfg. Co. . . . *
Cyclotherm Div., National-U. S. Radiator Corp. 252

Davis Eng. Corp. . . . *
DeBothezat Fans Division American Machine & Metals, Inc. . . . 3
Detroit Stoker Co. . . . *
DeZurik Corporation . . . *
Diamond Mfg. Co. . . . 303
Dodge Mfg. Co. . . . 229
Dover Mfg. Co. . . . *
Dravo Corp. . . . 213
Drayer-Hanson, Div. of Natl.-U.S. Radiator Corp. 283

Continued on Page 306

Measure Steam in POUNDS, not GUESSES!

. . . with Builders-Providence PRESSURE-COMPENSATED Shuntflo® Meter!!

STEAM COSTS MONEY! Get an **exact accounting** of steam delivered to process, area, or building. The proven Shuntflo meter and its new PRESSURE-COMPENSATED COUNTER prevents unintentional steam give-away . . . particularly in installations subject to wide pressure fluctuations.

CHECK THESE ADVANTAGES . . .

- **Completely self-contained and self-operated**
- **High accuracy . . . to within ±2% of actual rate of flow**
- **Easy to install . . . in 1" to 24" lines**
- **Open upper limit . . . permits temporary overloads up to 150%**
- **Pressure compensation . . . continuous and automatic . . . corrects for line pressure variations**
- **No stuffing box . . . makes meter leakproof**
- **Low initial cost, low maintenance cost**

FREE BULLETIN shows how easy it is to change steam losses to profits. Request Bulletin 400.20 today! Write **Builders-Providence, Inc., 381 Harris Ave., Providence 1, R. I.** . . . manufacturers of precision instruments and equipment for the *positive control of materials in motion.*

BUILDERS-PROVIDENCE
DIVISION OF
B-I-F INDUSTRIES BIF METERS FEEDERS CONTROLS

Water Hammer PROTECTION FOR SOCONY MOBIL BUILDING • NEW YORK

Architect: Harrison & Abramovitz

Engineer for Plumbing, Heating and Air Conditioning: Jaros, Baum and Bolles

Plumbing Contractor: Eugene Duklauer Inc.

Heating and Air Conditioning Contractor: Kerby Saunders

Center-Guided Type for 1" to 10" lines. Other types for lines to 24".

WILLIAMS -HAGER FLANGED

Silent CHECK VALVES

Here again on a major American building protection against water hammer is assured by Williams-Hager Silent Check Valves. The valves operate instantly when flow reversal starts or when flow is zero.

Write for Bulletins:

No. 654 on the Valves

No. 851 on Cause, Effect and Control of Water Hammer

THE WILLIAMS GAUGE CO., INC.

155 Stanwix Street
2 Gateway Center Pittsburgh 22, Pa.

Our 72nd Year • 1886-1958

INDEX TO ADVERTISERS

Continued from page 304

Dresser Mfg. Division ..... *
Dunham-Bush, Inc. 4
Durabla Mfg. Co. ..... *
Duro-Dyne Corp. ..... *
Dwyer Mfg. Co., F. W. 249

Eagan Co., Inc., Walter H. 276
Eigen Mfg. Corp. ..... *
Ellicott Fabricators, Inc. 210
Elliott Co., div. of Carrier Corp. ..... *
Emerson Electric Mfg. Co. 217
Enterprise Div. General Metals Corp. 254
Evans Corp., The George ..... *
Everlasting Valve Co. 212

Fairbanks Co., The 271
Fairbanks, Morse & Co. ..... *
Fairmont Aluminum Co. ..... *
Farr Co. ..... *
Field Control Div., H. D. Conkey & Co. ..... *
Finn & Co., Inc., T. R. 222
Fisher Governor Co. 62, 63
Fitzgibbons Boiler Co., The 263
Flexible Tubing Corp. ..... *
Flexonics Corp. 235
"Freon" Products div., duPont de Nemours & Co. Inc., E. I. 197
Frick Co. 32
Fulton Sylphon Div., Robertshaw-Fulton Cont. Co. ..... *
Furnas Electric Co. 289

G. & O. Mfg. Co., The 76
Gallaher Co., The 29
General Air Products Corp. 272
General Blower Co. 250
General Chemical Division, Allied Chemical Corp. 186
General Controls Co. 83
General Electric Co. ..... *
Glo-Brite Products ..... *
Goodall Rubber Co. 256
Goodrich, Chemical Co., B. F. ..... *
Goodrich, B. F., Sponge Products Div. ..... *
Goodyear Tire & Rubber Co., Inc. ..... *
Gordon & Piatt, Inc. 273
Governair Corp. ..... *
Grasselli Chemicals Dept., duPont de Nemours & Co., Inc., E. I. ..... *
Green Fuel Economizer Co., Inc. ..... *
Greenheck Fan & Ventilator Corp. 301
Greenlee Tool Co. 295
Grinnell Co., Inc. ..... Inside Front Cover
Gustin-Bacon Mfg. Co. 84

Hagan Chemicals & Controls, Inc. 286
Halstead & Mitchell 26
Hammond Brass Works 15
Handy & Harman ..... *
Hanson, Elof, Inc. 285
Hart & Cooley Mfg. Co. 282
Havens Structural Steel Co., Cooling Tower Div. ..... *
Hayes Furnace Mfg. & Supply Co. ..... *
Hendrick Mfg. Co. 291
Henry Valve Co. ..... *
Hoffman Specialty Mfg. Corp. 65
Hussey & Co., C. G. ..... *

Ilg Electric Ventilating Co. 231, 232, 233
Illinois Engineering Co., Div. of American Air Filter Co. 38, 39
Illinois Testing Laboratories ..... *
Independent Register Co., The 218
Industrial Acoustics Co., Inc. 91
Industrial Combustion, Inc. 230
Ingersoll-Rand Co. ..... *
International Boiler Works Co., The ..... *
Iron Fireman Mfg. Co. 27

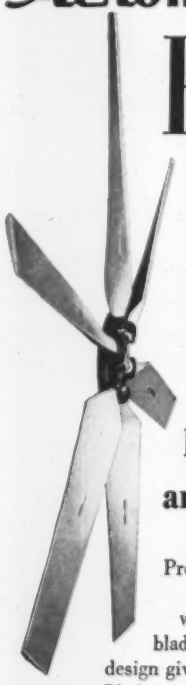
Janitrol Heating & Air Conditioning Div., Surface Combustion Corp. ..... *
Jenkins Bros., Inc. 204
Jenn-Air Co., Inc. 201
Jewel Mfg. Co., Inc. 302
Johns-Manville 8, 9, 287
Johnson Co., S. T. 285
Johnson Service Co. ..... Outside Back Cover
Jones & Laughlin Steel Corp. 54, 55
Joy Mfg. Co. ..... *

Kathabar Air Conditioning & Drying Div., Surface Combustion Corp. 73
Keasbey & Mattison Co. ..... *
Kennard Corp. ..... *
Kennedy Valve Mfg. Co. ..... *
Kewanee Boiler Division of American Standard ..... *
Kieley & Mueller, Inc. 66
Klipfel Valves, Inc. div of Hamilton-Thomas Corp. 273
Koppers Co., Inc., Fan Dept. 306
Koppers Co., Inc., Industrial Sound Control Dept. 40, 41

Continued on page 308

FAN tas tic

Aeromaster FANS



increase cooling tower efficiency with MORE CFM and LESS HP

Precision engineered Aeromaster Fans with variable pitch blades and anti-flutter design give cooling at *lower cost.* Blades resist acids, alkalies, abrasion and weather. 4, 6 or 8 blade styles in 54" to 22' diameters. Before you replace or consider new equipment, write: KOPPERS COMPANY, INC., 6809 Scott Street, Baltimore 3, Md.

KOPPERS Aeromaster Fans

Engineered Products Sold with *Service*

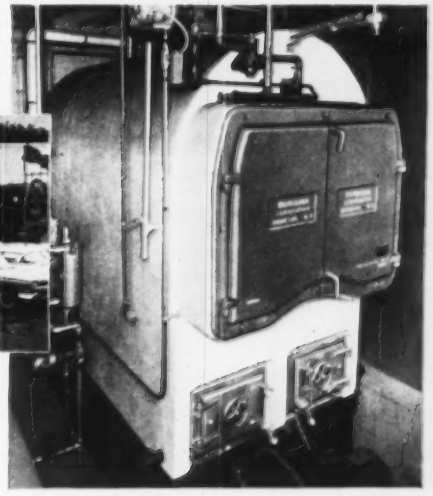
NEW BURNHAM SCOTCH TYPE BOILER FOR OIL, GAS, OR OIL/GAS COMBINATION

The hit of the O.H.I. Show, over 10,000 members of the heating trade stopped to see this versatile new packaged steel boiler. Its burners were selected after exhaustive testing to find the ideal combustion units to package with the fine Burnham boiler. It is factory assembled and tested . . . ready for final piping and wiring connections. Available in 8 sizes, Certified Ratings from 4,740 to 12,750 sq. ft. E.D.R. steam. Comparable ratings for water. Standard Scotch Type models available in sizes up to 4,000 sq. ft. of heating surface.

BURNHAM'S "OLD RELIABLE" COMPACT TYPE BOILER

...ideal for schools, apartments, all commercial buildings

MUTUAL OLDSMOBILE, INC. ..... *(Springfield, Mass.)*
J. C. PLANTE & SON, INC. ..... *(East Long Meadow, Mass.)—Heating Contractor*
UNITED PLUMBING SUPPLY, INC. ..... *(Springfield, Mass.)—Wholesaler*



Mutual Oldsmobile's Burnham 60-98 Compact Type Boiler is oil-fired for hot water heating. Has induced draft fan and tankless domestic hot water heater.

For compactness, reliability and fuel efficiency, these welded steel boilers have been famous for over 25 years. They compress the utmost heating capacity into the practical minimum of floor space. Compact Type Boilers are available in capacities from 2,600 to 35,000 sq. ft. E.D.R. net steam, with comparable ratings for water. All are S.B.I. ratings.

Burnham Corporation

STEEL BOILER DEPARTMENT
IRVINGTON, NEW YORK

MEMBER SBI

Sales Representatives throughout the U.S.A.

Burnham Corporation HP-98
Steel Boiler Dept.
Irvington, New York

Please give me, without obligation, full ratings and data on:
Scotch Type Boilers ☐ Boiler-Burner Packages ☐ Compact Boilers ☐

Name .....
Address .....
City ..... State .....

for peace of mind when the pressure is on...

...Capitol 3000# and 6000# forged steel couplings

for all high-pressure installations

Full couplings and half couplings are available from stock for prompt shipment in all sizes from 1/8" through 4".

Manufactured to ASTM Specifications A-105.

ORDER EVERY TYPE OF COUPLING FROM

CAP CAPITOL
MFG. & SUPPLY CO.
COLUMBUS, OHIO

COUPLINGS — NIPPLES — UNIONS — BUSHINGS — PLUGS — REDUCERS — CAPS—CAPADAPTERS—WELL SUPPLIES

INDEX TO ADVERTISERS

Continued from page 306

Kramer Trenton Co. ... *

Lennox Industries, Inc. ... 10, 11, 37
Leslie Co. ... *
Lewin-Mathes Co. ... 31
L. O. F. Glass Fibers Co. ... 20

Manning & Lewis Engineering Co. ... *
Marathon Electric Mfg. Corp. ... *
Marley Co., The ... 24
Marlo Coil Co. ... *
Marsh Heating Equipment Co. ... 309
Marsh Valve Co. ... 261
McDonald Mfg. Co., A. Y. ... *
McDonnell & Miller, Inc. ... 79
McQuay, Inc. ... 21
Mercoid Corp., The ... *
Mettler Div., Eclipse Fuel Engrg. Co. ... *
Mid-Continent Metal Prod. Co. ... 299
Midwest Piping Company, Inc. ... 17
Miller Electric Mfg. Co., Inc. ... *
Miller Valve Co., Inc. ... 290
Minneapolis-Honeywell Regulator Co. ... 241, 242, 243, 244, 245, 246, 247
Miracle Adhesives Corp. ... *
Modine Mfg. Co. ... 100, 101
Monarch Mfg. Works, Inc. ... 300
Moore, Inc., Goodloe E. ... 268
Morrison Products, Inc. ... *
Mortell Co., J. W. ... 224
Mt. Hawley Mfg. Co. ... *
Mueller Steam Specialty Co., Inc. ... *
Multi-Vent Div., Pyle-National Co., The ... 28
Murray Mfg. Co., D. J. ... *
Myers & Bro., F. E. ... *

Nash Eng. Co., The ... 112
National Heater Co., The ... 295
National Tube Div., United States Steel Corp. ... *
National-U. S. Radiator Corp. ... 214
Nelson, Herman Div. of American Air Filter Co., Inc. ... 38, 39
Nesbitt, Inc., J. J. ... *
New York Blower Co., The ... 72
Niagara Blower Co., The ... 310
NIBCO Inc. ... *
Norman Products Co. ... *
Norwood Prod. Co., Div. of A. R. Wood Mfg. Co. ... *

Oakite Products, Inc. ... *
Ohio Brass Co. ... *
Ohio Injector Co., The ... *
Orr & Sembower, Inc. ... 304
Oster Mfg. Co. ... *
O T M Corp. ... *
OverHead Heaters, Inc. ... *

Palmer Thermometers, Inc. ... *
Pantex Mfg. Corp. Hydraulic Div. ... *
Paragon Electric Co. ... *
Patterson-Kelley Co., Inc., The ... 277
Peerless Electric Co., The ... 82
Peerless Pump Div., Food Machinery and Chemical Corp. ... 259
Penn Ventilator Co. ... 294
Pennsalt Chemicals Corp. ... *
Petro ... 219
Petrometer Corp. ... 291
Phelps Dodge Copper Products Corp. ... *
Phillips Cooling Tower Co., Inc. ... 257
Pittsburgh Plate Glass Co., The Fiber Glass Division ... 61
Polis Mfg. Co. ... 76
Porter & Co., H. W. ... 278
Porter Co., Inc., H. K., WS Fittings Div. ... 258
Porter Co., R. C. ... *
Portmar Boiler Co., Inc. ... *
Powell Valves ... 56
Power Line Fan Co., Div. of Chelsea Fan & Blower, Inc. ... 223
Powers Regulator Co. ... 185
Prat-Daniel Corp., Thermobloc Div. ... 270
Precision Thermometer & Instrument Co. ... *
Preferred Utilities Mfg. Corp. ... *
Pritchard Co. of California, J. F. ... 77
Propellair Div., Robbins & Myers, Inc. ... *

Quickdraft Company ... 274

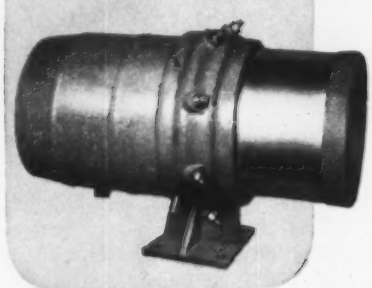
Radiator Specialty Co. ... 302
Ramset Fastening System Winchester-Western Div., Olin Mathieson Chemical Corp. ... 260
Ray Burner Co. ... 226
Raypak Co., Inc. ... *
Reading Tube Corp. ... 211
Recold Corp. ... *
Reed Mfg. Co. ... 220
Reliance Electric & Eng. Co. ... *
Reliance Gauge Column Co. ... 262
Remington Arms Co. ... 23
Rempe Co. ... 301

Continued on page 310

important points about joints

- Yarway Gun-Pakt Joints are serviced *in the line under full steam pressure.*
- Costly shutdowns eliminated.
- Maintenance records show 1 manhour per year per joint.
- Fewer expansion joints needed per length of pipeline with Gun-Pakt.

YARWAY GUN-PAKT EXPANSION JOINTS



For new Yarway Expansion Joint Catalog EJ-1916 write YARNALL-WARING CO., 107 Mermaid Lane, Phila. 18, Pa.

go YARWAY *with confidence*

The MARSH way is the SURE way—

You'll have a new conception of how *uniformly good* radiator valves, traps and vents can perform when you make the job Marsh all the way through.

Take the Radiator Valve and Trap illustrated here, for instance:

The Marsh Radiator Valve is *truly* packless—not just *called* packless. This valve has no "packing" whatever... instead, the ingenious Marsh annular mechanical seal that keeps it drip tight throughout its far longer life.

And Marsh Radiator Traps are equally sure-footed... have the famous Marsh Diaphragm—extremely rugged, but so sensitive that it never fails to close tight on steam, yet opens instantly to pass condensate and air at only a few degrees below closing temperature.

Yes, the Marsh way is the sure way... Valves, Traps, Vents, F & T Traps, designed, built and tested to give lasting satisfaction in the Marsh tradition. Ask for up-to-date Heating Specialties Catalog 76-H.

MARSH HEATING EQUIPMENT CO.
Sales Affiliate of Jas. P. Marsh Corporation
Dept. T, Skokie, Illinois
Marsh Instrument & Valve Co., (Canada) Ltd.
8407 103rd St., Edmonton, Alberta, Canada

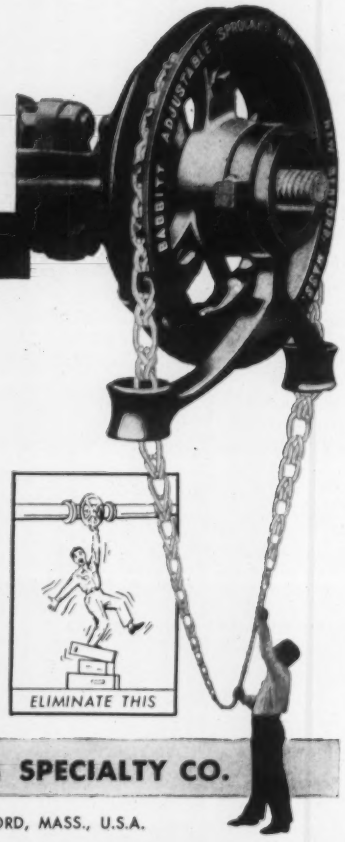
MARSH *Heating Specialties*
SINCE 1865

Safe Operation of Overhead Valves with a

Babbitt

Adjustable
SPROCKET RIM
with Chain Guide

- Simplifies pipe layout
- Fits any size valve wheel
- Easy to install and operate
- Operates any valve from plant floor
- Time and money saving fixture
- No maintenance; first cost only cost
- Packed, completely assembled, one to a carton
- Hot galvanized, rust-proof chain available for all sizes
- Easy to follow instructions with each unit
- Your supplier carries complete stocks
- Write for new descriptive catalog sheet and prices



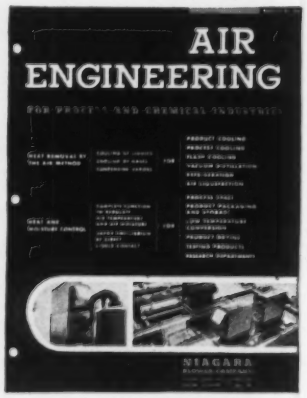
Babbitt STEAM SPECIALTY CO.

8 BABBITT SQUARE, NEW BEDFORD, MASS., U.S.A.

AIR ENGINEERING by NIAGARA

- AIR CONDITIONING with precise regulation of air temperature and air moisture for processing, for product drying, packing, storing, low temperature conversion, for testing and research.
- "NO FROST" REFRIGERATION for food and low temperature conversion, for testing and operations at extreme low temperatures; for moisture control below the freezing point of water.
- AFTER COOLING and air drying for large air and gas compressors and AIR LIQUEFACTION.
- COOLING ENGINES, COMPRESSORS, HYDRAULIC PRESSES.
- COOLING QUENCH BATHS, FURNACES, INERT ATMOSPHERES.
- COOLING ROLLS, WELDERS, DRAWING OR EXTRUSION DIES.
- PRODUCT AND PROCESS COOLING CHEMICALS OR INTERMEDIATES.
- COOLING LIQUIDS OR GASES IN CLOSED SYSTEMS.
- VAPOR CONDENSING UNDER VACUUM.
- REFRIGERANT CONDENSING.
- ELECTRONIC PROCESS COOLING.

You will reduce your costs, solve your problems of water supply or disposal and get HIGH OPERATIONAL EFFICIENCY with Niagara "Aero" Evaporative Heat Exchangers, After Coolers, Condensers, Air Conditioners or Coolers for these important plant services or processes.



Write for this Bulletin No. 135

High operational efficiency means: precise temperature for improved product and process quality control, heat removal at rate of input, simple operating conditions, real economy in upkeep, sustained full capacity. It means the lowest expense for up-keep.

Write for Bulletin 135

NIAGARA BLOWER COMPANY

Dept. HP-9, 405 Lexington Ave., New York 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

INDEX TO ADVERTISERS

Continued from page 308

Republic Steel Corp.	*
Research Products Corp.	269
Revere Copper & Brass, Inc.	255
Reznor Mfg. Co.	301
Richmond Engineering Co., The	99
Ric-wil, Inc.	*
Ridge Tool Co., The	109
Roberts-Gordon Appliance Corp.	297
Robvon Backing Ring Co.	215
R-P & C Valve Div. — Amer. Chain & Cable Co., Inc.	*
Rotherm Engineering Co., Inc.	*
St. Clair Rubber Co.	302
Sarco Co., Inc.	16
Sarcotherm Controls, Inc.	*
Shaw-Perkins Mfg. Co.	288
Skidmore Corp.	34
Slant-Fin Radiator Corp.	195
Sonoco Products Co.	199
Spang-Chalfant Div. of The National Supply Co.	225
Speedline Fittings Div. Horace T. Potts Co.	*
Spence Eng. Co.	*
Sporlan Valve Co.	*
Standard Stamping & Perforating Co.	292
Stephens-Adamson Mfg. Co.	*
Sterling, Inc.	299
Stic-Klip Mfg. Co.	*
Stoddard Industries, Inc.	296
Superior Combustion Industries, Inc.	192
Surface Combustion Corp.	73
Swartwout Co., The	110
Taco Heaters, Inc.	*
Taylor Forge & Pipe Works	*
Taylor Instruments Cos.	287
Thermal Engineering Corp.	280
Therm-O-Disc, Inc.	*
Titus Mfg. Co.	12, 13
Titusville Iron Works Co. The Div. of Struthers Wells Corp.	*
Torrington Mfg. Co.	70, 71
Trane Co., The	196
Trerice Co., The H. O.	*
Tube Turns, Inc.	*
Tuthill Pump Co.	289
Tuttle & Bailey Div. of Allied Thermal Corp.	*
Typhoon Air Conditioning Co., Inc.	*
Union Carbide Chemicals Co., Div. of Union Carbide Corp.	80, 81
United Cork Companies	227
United Sheet Metal Co., The	14
U. S. Flexible Metallic Tubing Co.	194
United States Gauge Div., American Machine & Metals, Inc.	*
United States Register Co.	*
United States Ruober Co.	207
United States Steel Corp.	*
United Wire & Supply Co.	*
Universal Diffuser Corp.	18, 19
Van Packer Co., Div. of The Flintkote Co.	265
Vapor Heating Corp.	*
Vibration Mountings, Inc.	*
Vilter Mfg. Co., The	*
Wagner Electric Corp.	35, 36
Waldron Corporation, John	*
Walker Mfg. & Sales Corp.	*
Walworth Co.	209
Waterloo Register Co.	*
Watts Regulator Co.	107
Webster & Co., Warren	95
Webster Engineering Co., The	*
Weil-McLain Co.	203
Weil Pump Co.	297
Weinman Pump Mfg. Co., The	*
Weirton Steel Co.	60
Westinghouse Electric Corp., Apparatus Div.	57, 58, 59
Westinghouse Electric Corp., Sturtevant Div.	*
Wheatland Tube Co.	234
Wheel Trueing Tool Co.	298
Wheelco Instrument Div., Barber-Colman Co.	*
Wheeling Steel Corp.	239
Whitlock Mfg. Co., The	*
Will-Burt Company, The	*
Williams Gauge Co.	306
Wilson Engrg. Co.	*
Wilson Inc., Grant	*
Wing Mfg. Co., L. J. div. of Aero Supply Mfg. Co., Inc.	*
Wiremold Co., The	*
W-K-M div of ACF Industries, Inc.	301
Wolverine Tube Div. of Calumet & Hecla, Inc.	75
Worcester Valve Co., Inc.	*
Worthington Corp.	253
Yarnall-Waring Co.	308
York Corp.	74
York-Shipley, Inc.	96
Youngstown Sheet & Tube Co.	193
Yuba Consolidated Industries, Inc., Adsco Div.	111
Yula Water Heaters, Inc.	85
Zallea Bros.	*
Zonolite Co.	*

MEMO TO MEN
ON THE WAY UP

WHERE THERE'S BUSINESS ACTION THERE'S A BUSINESSPAPER

Used to be a song, back in the Thirties, titled, *Little Man, You've Had a Busy Day.* Didn't mention the Big Man. But his days are busy, too. He's the man who must make top-level decisions in business. And to make those decisions, he must have facts. All the facts. All the pertinent information he can get.

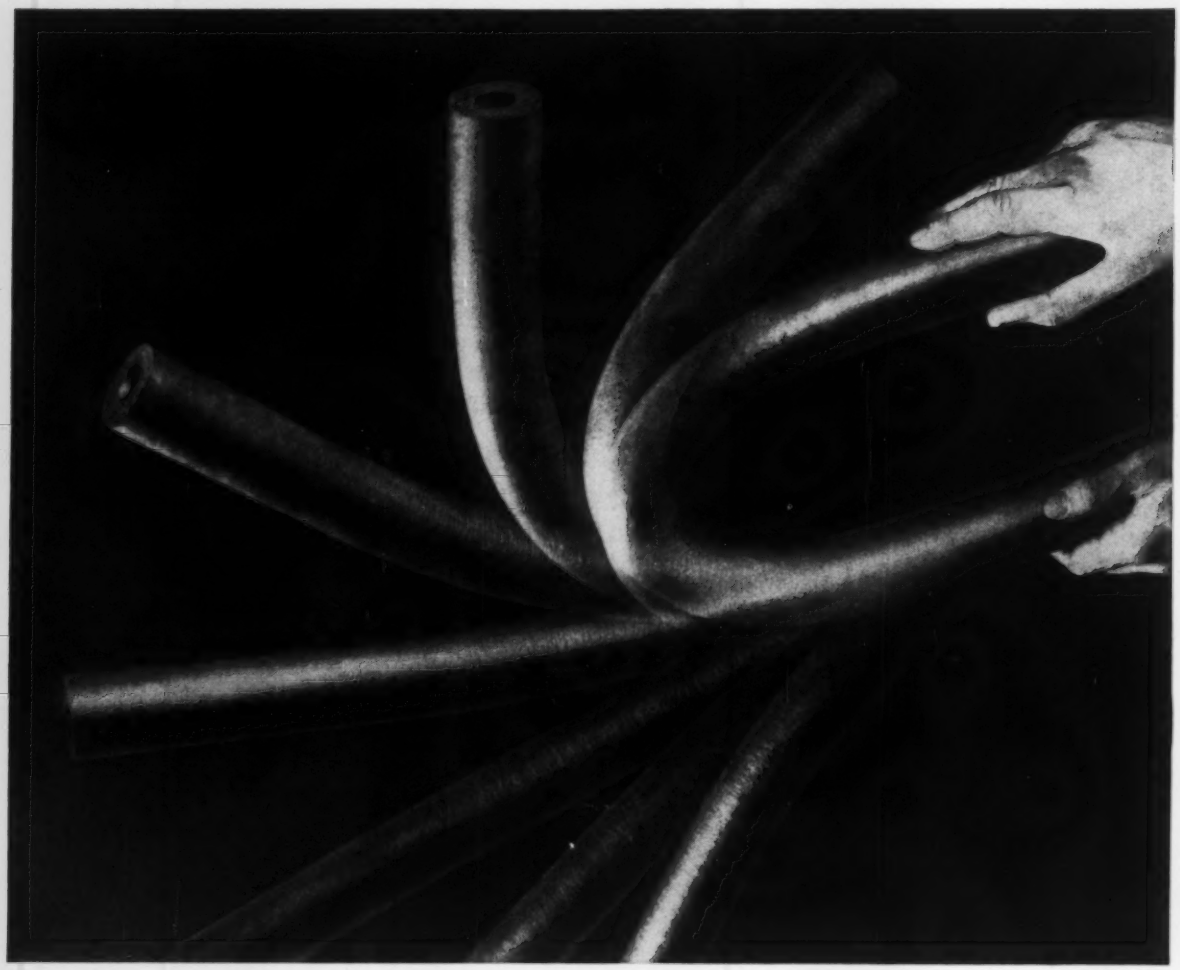
He finds time, in his busy days, to get that information. How? By getting a major portion of it from one unique source: the business publications serving his particular field.

No businessman, Little or Big, is fully informed until he reads his businesspaper. He reads it for profit, not for pleasure. He searches it through for news of the trade or industry. For facts. For fresh ideas. For new products he can put to work. And he reads the advertising with the same intense concentration he devotes to the editorial pages.

For the man on his way toward becoming a Big Man, his businesspaper is especially important. Take a tip from the reading habits of key men at every level. Take out a subscription of your own. Then, make the time to read every issue—and read it thoroughly.

Heating, Piping & Air Conditioning

One of a series of advertisements prepared by THE ASSOCIATED BUSINESS PUBLICATIONS



Armaflex is extremely flexible, follows contours of piping or tubing without special cutting.

Highly flexible Armaflex pipe covering goes on fast, cuts labor costs in half

Highly efficient, Armaflex stops condensation on refrigeration and air-conditioning lines. Its closed cell structure completely seals out air and moisture.

So flexible it can be tied in knots, Armaflex pipe covering helps speed the insulation of fluid cooling lines. It reduces labor costs as much as 50% compared with the cost of applying conventional insulations to pipes and fittings. Armaflex can be slipped over pipe or tubing before connections are made. It follows contours readily. Or, the covering may be slit lengthwise, snapped in place, and cemented at the joints. Fitting covers are quickly fabricated from miter-cut pieces.

Made of foamed plastic, Armaflex has a closed cell structure that seals out air or moisture. No separate vapor barrier is needed. Armaflex is an unusually efficient insulation with a k-factor of 0.28 at 75° mean temperature.

Because Armaflex now comes in three wall thicknesses – 3/8", 1/2", and 3/4" – you can specify the economical amount* of insulation needed to stop condensation, or to save heat, on lines operating from 200° F. down to zero. Armaflex is available in 6' lengths and sizes up to 3" I.P.S. For larger piping, Armaflex sheets are used.

* Recommended Armaflex thicknesses for various service conditions are contained in a free descriptive booklet. For your copy, write Armstrong Cork Company, 2209 Sherman Street, Lancaster, Pennsylvania.

Armstrong INSULATIONS

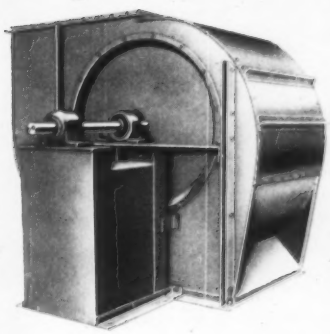
CLARAGE FANS FOR YOUR INDUSTRIAL AIR TRAVEL

Blowers and exhausters for
diversified industrial applications.

Standard models promptly available.

Clarage builds air handling and
conditioning equipment exclusively —
concentrated know-how!

When you want equipment designed
and built for "the long pull"—
to stretch your equipment dollar
to the utmost — call on
CLARAGE FAN COMPANY, Kalamazoo, Mich.

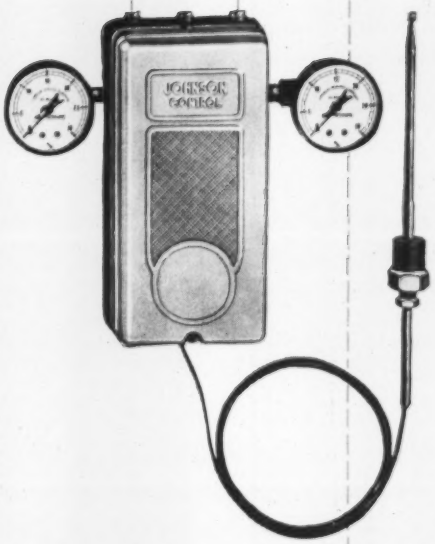


CLARAGE

. . . dependable equipment for making air your servant

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

T-1220 REMOTE BULB TEMPERATURE TRANSMITTER
FOR PNEUMATIC TRANSMISSION SYSTEMS



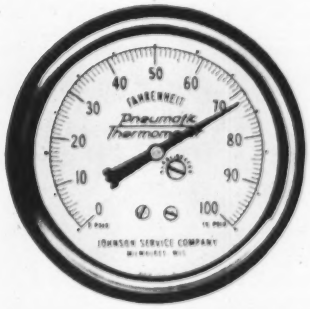
- Measures and transmits, to a pneumatic receiver at a control center, temperatures in ducts, pipes, tanks or other equipment requiring accurate remote temperature measurement and control. The pneumatic receiver at the central panel provides, singly or in any combination, centralized indication, control or recording of the transmitted temperature.
- Compensated liquid filled measuring element.
- Pneumatic sensitivity feature (feedback) assures stable, highly accurate response over the entire temperature range.
- Transmission of temperature measurements by this specially designed instrument is unaffected by humidity, ambient temperature, transient electrical currents, voltage fluctuations or other variables.

For full details, write for Bulletin T-1220. Johnson Service Company, Milwaukee 1, Wisconsin.

applications of pneumatic transmission . . .

Pneumatic transmission systems for centralized indication and control are applied to all types and sizes of air conditioning, heating and ventilation systems. Johnson's complete line of pneumatic transmission and control center instrumentation, much of it developed exclusively for this purpose, allows the *widest choice of features* to meet the exact needs of the individual building.

Ask a local Johnson engineer to give you the complete story.



TO RECEIVER-CONTROLLER

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885